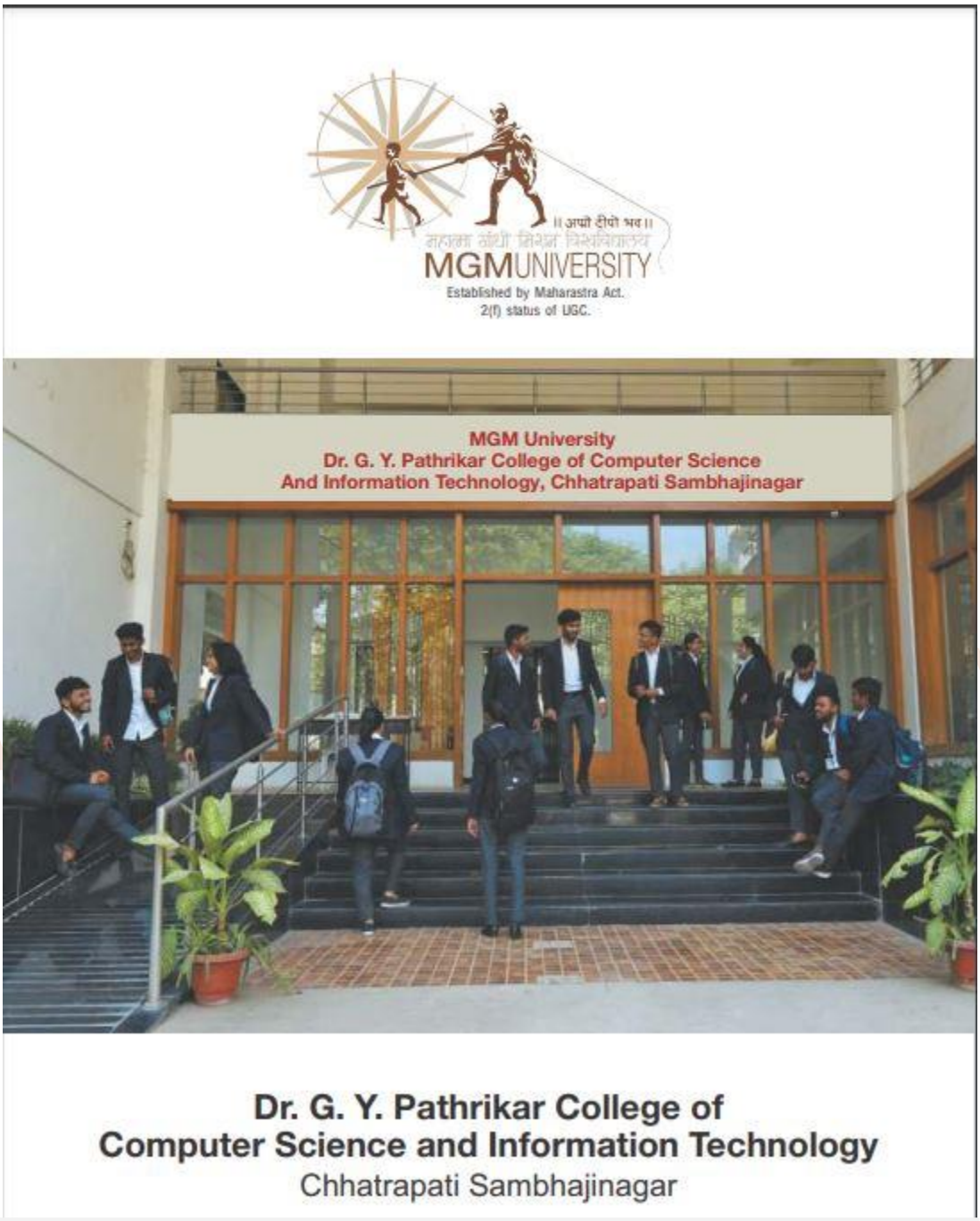

M.Sc. Computer Science
First & Second Year
(Syllabus)

MGM University

Vision

- To ensure sustainable human development which encourages self-reliant and self-content society.
- To promote activities related to community services, social welfare and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through vipassanna meditation and Gandhian Philosophy.
- To develop the culture of simple living and high thinking

Mission

- To impart state of art education and technical expertise to students and give necessary training to teachers to create self-reliant society for future.
- To encourage students to participate in Indian and International activities in sports, literature, etc. so that future generation becomes base for free and liberal society
- To educate students in areas like Management, Finance, Human relations to inculcate philosophy of simple living and high thinking value of simple economic society.
- To inculcate culture of non-violence and truthfulness through Vipassana.

  To sustain activities of Indian culture (viz. classical dance, music and fine arts) through establishing institutes like Mahagami, Naturopathy, etc.

विद्यापीठ गीत

अत्त दिप भव भव प्रदिप भव,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

अत्ताहि अत्त नो नाथो ,

अत्ताहि अत्त नो गति

अत्त मार्गपर अप्रमादसे है तुझे चलना

सब्ब का कल्याण हो ,

वो कार्यकुशल करना

सब्ब का उत्तम मंगल , पथप्रदर्शक हो

अत्त दिप भव भव प्रदिप भव ,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

बुद्धमं शरनं गच्छामि :

धम्मं शरनं गच्छामि :

संघं शरनं गच्छामि :

Dr. G. Y. Pathrikar College of Computer Science & Information Technology

MGM college of Computer Science and Information Technology was established in 2001 offering undergraduate and postgraduate degree program in Computer Science and Information Technology. College was renamed as Dr.G.Y.Pathrikar College of Computer Science and Information Technology in 2003 in memory of great educationalist, one of the founder member and Ex-Secretary MGM, Dr.G.Y.Pathrikar Sir.

It is first self-financed ISO certified institution offering program dedicated to Computer science and Information technology in Maharashtra and has achieved status of 2f/12b. Ours was the only and first college to be re-accredited as A+ grade with NAAC in the year 2017. Experienced and qualified faculty with Ph.D is strength of our college. Starting with 77 student's College has crossed total students strength of 10,000 passing out. Student are doing well in various MNCs like Infosys, Tech-Mahindra, Wipro, Capgemini, Cognizant etc. Many have their own Startups. Some of the students have completed their Masters and Ph.D. program from foreign countries like US, UK, Australia. Now we are constituent college of MGM University, ChhatrapatiSambhajinagar.

Vision

To be an academic institution in dynamic equilibrium in social, ecological and economical environment striving continuously for excellence in total quality education, research and technological service to the nation.

Mission

- To create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, and economical issues.
- To upgrade our students in all respect with the help of latest infrastructure in the area of Computer Science and Information Technology in order to build the National Capabilities.
- To understand the culture of Non-violance, truth, peace through Gandhian Philosophy.

Programs offered at Dr. G. Y. Pathrikar College of Computer Science &InformationTechnology

Undergraduate Programmes	Postgraduate Programmes	PhD Programmes
B.Sc(Computer Science) Honours/ Honours with Research	M.Sc(Computer Science)	Ph.D. in Computer Science and Information Technology
B.Sc(Information Technology) Honours/ Honours with Research	M.Sc(Information Technology)	
BCA(Science) Honours/ Honours with Research	M.Sc(Data Science)	
B.Sc(Animation) Honours/ Honours with Research	[M.Sc(Animation)	
Integrated M.Sc. Data Science		
BCA(Digital Marketing)Honours		
B.Sc(Robotics) Honours		

Name of Program – M.Sc. (Computer Science)

Duration – Two Years

Eligibility -

- Any Science Graduate with Computer Science as one or all subject or graduate of engineering and technology of this University or any other recognized university as equivalent with minimum 50% marks (45% for reserved category) can apply.

Name of Faculty: Basic and Applied Sciences
Name of the College/Institute/Department/School: Dr. G. Y. Pathrikar College of CS & IT
Name of the Programme: M. Sc. (Computer Science) **Programme Type (UG/PG)**: PG
Duration: 2 Years

First Year - Semester I

Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	MCS41MML501	Digital Image Processing	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MML502	Data Warehousing	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MML503	Web Development and JavaScript	Lecture	3	3	-	60	40	100	-	16	40
RM	MCS41RML501	Research Methodology	Lecture	4	4	-	60	40	100	-	16	40
ME		Elective from Basket-1	Lecture	3	3	-	60	40	100	-	16	40
MM	MCS41MMP501	Practical Based on Digital Image Processing	Practical	1	-	2	30	20	50	-	08	20
MM	MCS41MMP502	Practical based on Data warehousing	Practical	1	-	2	30	20	50	-	08	20
MM	MCS41MMP503	Practical Based on Web Dev. Using JavaScript	Practical	1	-	2	30	20	50	-	08	20
ME		Practical based on elective-1	Practical	1	-	2	30	20	50	-	08	20
		Total		**20**	**16**	**8**	**420**	**280**	**700**	-	-	-

Note:
Nature of Course :L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,
Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

First Year- Semester II

Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	MCS41MML504	Pattern Recognition	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MML505	Data Mining and Visualization	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MML506	Python Programming	Lecture	3	3	-	60	40	100	--	16	40
ME		Elective from Basket-2	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MMP504	Practical Based on Pattern Recognition	Practical	1	-	2	30	20	50	--	08	40
MM	MCS41MMP505	Practical based Data Mining & Visualization	Practical	1	-	2	30	20	50	--	08	20
MM	MCS41MMP506	Practical Based Python Programming	Practical	1	-	2	30	20	50	--	08	20
ME		Practical based on elective	Practical	1	-	2	30	20	50	--	08	20
OJT	MIT41JTJ501	On Job Training / Internship	Practical	4	-	8	60	40	100	--	--	40
Total				**20**	**12**	**16**	**420**	**280**	**700**	--	--	--

Note:

Nature of Course :L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,
Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project.

Second Year- Semester III

Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	MCS41MML601	Computer Vision	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MML602	Biometric Techniques	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MML603	Internet of Things (IOT)	Lecture	3	3	-	60	40	100	--	16	40
ME		Elective from Basket-3	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MMP601	Practical Based on Computer vision	Practical	1	-	2	30	20	50	--	08	40
MM	MCS41MMP602	Practical based Biometric Techniques	Practical	1	-	2	30	20	50	--	08	20
MM	MCS41MMP603	Practical Based on Internet of Things	Practical	1	-	2	30	20	50	--	08	20
ME		Practical based on elective 3	Practical	1	-	2	30	20	50	--	08	20
RP	MCS41RPP601	Research Project	Practical	4		8	60	40	100	--	16	40
Total				**20**	**12**	**16**	**420**	**280**	**700**			

Second Year- Semester IV

Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	MCS41MML604	Machine Learning	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MML605	Natural Language Processing	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MML606	Remote Sensing and GIS	Lecture	2	2	-	30	20	50	--	08	20
ME		Elective from Basket-4	Lecture	3	3	-	60	40	100	--	16	40
MM	MCS41MMP604	Practical Based on Machine Learning	Practical	1	-	2	30	20	50	--	08	40
MM	MCS41MMP605	Practical Based on NLP	Practical	1	-	2	30	20	50	--	08	20
ME		Practical Based on Elective from Basket-4	Practical	1	-	2	30	20	50	--	08	20
RP	MCS41RPP602	Research Project	Research Project	6		12	120	80	200	--	32	80
Total				**20**	**11**	**18**	**420**	**280**	**700**			

Elective Baskets

Basket-1

Code	Title
MCS41MEL501	Data Management Tools
MCS41MEL502	Data Structure and Algorithm
MCS41MEL503	Advance Operating System
MCS41MEL504	Cloud Computing with AWS
MCS41MEP501	Practical Based on Data Management Tools
MCS41MEP502	Practical Based on Data Structure and Algorithms
MCS41MEP503	Practical Based on Adv. Operating System
MCS41MEP504	Practical Based on Cloud Computing with AWS

Basket-2

Code	Title
MCS41MEL505	Intellectual Property Rights
MCS41MEL506	React JS
MCS41MEL507	Neural Network
MCS41MEL508	Ethics and Cyber Security
MCS41MEP505	Practical Based on Intellectual Property Rights
MCS41MEP506	Practical Based on React JS
MCS41MEP507	Practical Based on Neural Network
MCS41MEP508	Practical Based on Ethics and Cyber Security

Basket-3

Code	Title
MCS41MEL601	Block Chain
MCS41MEL602	Data Analytics
MCS41MEL603	Neural Network with Fuzzy Logic
MCS41MEL604	Native React
MCS41MEP601	Practical Based on Latex
MCS41MEP602	Practical Based on Data Analytics
MCS41MEP603	Practical Based onNeural Network with Fuzzy Logic
MCS41MEP604	Practical Based on Native React

Basket-4

Code	Title
MCS41MEL605	AWS DevOps
MCS41MEL606	Quantum Computing
MCS41MEL607	Software Testing and Verification
MCS41MEL608	Digital Forensics
MCS41MEP605	Practical Based on AWS DevOps
MCS41MEP606	Practical Based on Quantum Computing
MCS41MEP607	Practical Based onSoftware Testing and Verification
MCS41MEP608	Practical Based on Digital Forensics

Semester: FIRST

Syllabus
Semester-I

Course code: MCS41MML501	**Course name:** Digital Image Processing
Course category: Major Mandatory	**Credits: 3**
Pre-requisites: Basics of mathematics	
Course Objectives:	
1. To improve pictorial information for human interpretation.	
2. Processing of image data for tasks such as storage, transmission and extraction of pictorial information	
Course Outcomes: At the end of the course, the students will be able to -	
CO1 : Understand the basic digital image processing operations	
CO2: Get familiar with the principal techniques used for spatial and frequency domain.	
CO3: Design GUI using digital image processing techniques	
CO4: Understand the fundamentals of color and different color models.	

Contents –

Unit	Topics to be Covered	No. of Lectures
1	**Introduction** What is Digital Image Processing? Applications of Image Processing, Fundamental Steps of Digital Image Processing, Components of an Image Processing System. Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition : Image Acquisition using a Single Sensor, Sensor Strips and Sensors Array, Image Sampling and Quantization.	8
2	**Image Enhancement and Filtering Techniques:** Intensity Transformation Function, Histogram Processing, Spatial Filtering, Spatial Correlation and Convolution, Generating Spatial Filter Mask, Smoothing Spatial Filters, Sharpening Spatial Filter. The Fourier Transform of Sampled Functions, Discrete Fourier Transform. A Model of Image Degradation/Restoration Process, Noise Models, Mean Filter, Order-Statistics Filter, Adaptive Filter, Bandpass Filter and Notch Filter. Wavelet Function, Wavelet Transform, Fast Wavelet Transform	8
3	**Image Compression and Morphological Operations** **Image Compression:**	10

	Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, Measuring Image Information, Image Compression Models. **Morphological Operations:** Erosion, Dilation, Duality, Opening and Closing, The Hit-or- Miss Transformation. Morphological Algorithms: Boundary Extraction, Hole Filling, Thinning, Thickening, Skeleton Prunning.	
4	**Image Segmentation** **Point, Line, and Edge Detection:** Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection. **Thresholding:** Basic Global Thresholding, Optimum Global Thresholding Using Otsu Method, Multiple Threshold, Variable Threshold **Region-Based Segmentation**: Region Growing, Region Splitting and Merging	8
5	**Color Image Processing:** Color Fundamentals, Color Model : RGB, CMY, CMYK, HSI, Pseudocolor, Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Image Segmentation Based on Color, Noise in Color Images.	10

Text Books: 1. Rafael C Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education, India 3rd Edition
2. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall
Reference Books: 1. Kenneth R. Castleman, Digital Image Processing, Pearson Education, India
2. Rafael C Gonzalez, Richard E. Woods, Steven L. Eddins, Image Processing Using MATLAB, McGraw Hill, 2nd Edition
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MMP501	Practical Based on Digital Image Processing	**--**	**1**	**30**		**20**	**50**	**1**
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Perform the different operations of different steps included in Digital Image Processing on an image							

List of Practicals:

Experiment No.	Experiment Topics
1	Write program for Histogram Equalization and Histogram Matching
2	Write program for Discrete Fourier Transform
3	Write program for Smoothing Sharpening Spatial Filter
4	Write program for Wavelet Transform
5	Write program for Image Compression
6	Write program for Image Segmentation using Thresholding
7	Write program for Line Detection
8	Write program for Noise Models
9	Write program for Region Growing
10	Write program for Color Model (RGB, CMY, CMYK, HSI)

Course code: MCS41MML502	**Course name:** Data Warehousing
Course category: Major Mandatory	**Credits:** 3
Pre-requisites: Pre-university mathematics	
Course Objectives:	
To have an understanding of the foundations, the design and maintenance.	
Have mastered the basic range of techniques for creating, controlling and navigating dimensional business databases,	
Course Outcomes:	
CO1 : Learning the steps for the preparation of plan to implement data warehouse.	
CO2: To have an understanding of the evolution and the use of data warehouses	
CO3: Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.	
CO4: being able to use a powerful tool for dimensional modeling and analysis.	

Contents –

UNIT	Topics to be covered	No. of Lect.
I	**Data Warehousing Concepts:** Need for Data Warehouse, History **Data Warehouse: The building blocks:** Features of Data Warehouse, Top down vs. Bottom up approach, Architectural types: centralized data warehouse, independent data marts, Federated.	8
II	**Components of Data Warehouse:** Source data component, data staging component, data storage component, information delivery component, metadata component, management and control component. **Metadata in the data warehouse:** types of metadata, special significance of metadata.	10
III	**Trends in Data Warehousing:** Continued growth in data warehousing, expansion, significant trends: Real time data warehousing, multiple data types, data visualization, parallel processing, data warehouse appliances, query tools, browser tools, data fusion, data integration, Analytics, Data Warehousing and CRM, Agile development. **Emergence of Standards:** Metadata, OLAP	10

IV	**Web Enabled Data warehouse:** The warehouse to the web, The web to the warehouse, The web enabled configuration. **Planning and project management:** Planning your Data Warehouse, Justify how different is your project, assessment of readiness, The life cycle approach, The development Phases: Adopting Agile technology, The Project team organization and management.	10
V	**Requirement Gathering Methods:** Types of questions, arrangement of questions, interview techniques, Adapting JAD methodology, Using Questionnaires, Review existing documentation **Scope and content:** Data source, data transformation, data storage, Information delivery, Information package diagrams. **Data Design and architectural plan:** Structure for Business Dimensions, Structure for Key measurements, levels of detail, composition of components, tools and products.	08

Text Book : 1 Paulraj Ponniah, Data Warehousing – Fundamentals for IT professionals, Willey Publication, 2nd Edition .
Reference Book: Kimball, Reeves Ross, Thornthwaite,, The Data Warehouse Lifecycle Toolkit, John Wiley & Sons.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	**Course Title**	**Teaching Scheme**		**Evaluation Scheme**				**Credit**
				Internal	**External**		**Total**	
		L	**P**		**ESE**	**PR**		
MCS41MMP502	Practical Based on Data Warehousing	**--**	**1**	**30**		**20**	**50**	**1**
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	To create, control, navigating dimensional databases by powerful tools for modeling and analysis..							

List of Practicals :

At least two experiments should be carried out on each unit.

Course code: MCS41MML503	**Course name:** Web Development and JavaScript
Course category: Major Mandatory	**Credits:** 3
Pre-requisites: Basic knowledge of web development	
Course Objectives:	
1. To provide the general mechanism and design of Automatic system	
2. Create highly responsive interfaces that improve the user experience and provide dynamic functionality.	
Course Outcomes:	
CO1 : Know variable naming rules and JavaScript data types	
CO2 : Identify expressions and operators	
CO3 : Handling Web Page.	
CO4 : Creating websites	

Contents –

UNIT	Topics to be Covered	No. of Lect.
I	**Introduction:** Introduction to HTML, Internet, Web server, web client/ browser, HTML Tags, Paired tags, Singular tags, Commonly used HTML commands: Structure of HTML Program, Titles, footers, text formatting, text styles, text effects, Lists, Types of list	08
II	**Adding graphics to HTML Page** Using the Border attribute, Using the width and height attribute,Using the align attribute , Linking documents, hyperlinks to a file , images as hyperlinks, image maps **Frames:** Introduction to frames, <FRAMESET>, <FRAME> tag, targeting named frames	08
III	**Working with CSS** Introduction to CSS, style sheets and HTML text properties: font, length, line box, text formatting, coloring, CSS Box model: properties, shorthand properties, background colors and images, Style properties, tables, lists.	08

IV	**JavaScript Basics and Strings** Basics and advantages of JavaScript, JavaScript in web pages: database connectivity, client-side JavaScript, Capturing User input, writing JavaScript into HTML, Data Type and literal: Number, Boolean, string, null, creating variables, Operators and its types, JavaScript arrays, Elements of Arrays. **JavaScript decision making** Decision Making with code, IF Statement, Else-if, Else, for loop, while loop, Built in functions	**10**
V	**Forms used by a website:** Properties of form elements, methods of form elements, text element, password element, button element, submit element, checkbox element, radio element, text area element, select and option element	**08**

Text Book : 1 Ivan Bayross, HTML, JavaScript, DHTML and PHP, BPB Publication, 4th edition.
Reference Book: Jeffrey C. Jackson, Web Technologies: A computer science perspective, LPE Publication.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	**Course Title**	**Teaching Scheme**		**Evaluation Scheme**				**Credit**
				Internal	**External**		**Total**	
		L	**P**		**ESE**	**PR**		
MCS41MMP503	Practical Based on Web Development and JavaScript	**--**	**1**	**30**	**-**	**20**	**50**	**1**
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Able to create website or web based application							

List of Practical's:-

At least two experiments should be carried out on each unit.

Course code: MCS41RML501	**Course name:** Research Methodology
Course category: Research Methodology	**Credits:** 4
Pre-requisites: Importance of research	
Course Objectives:	
1 To understand the state-of-the-art in research methodology.	
2. Survey the currently available systems	
Course Outcome:	
CO1: Demonstrate knowledge of research methodology. Understand the Research Problem	
CO2: Understand the Research Design	
CO3: Understand Sampling Design, Measurement and Scaling Techniques	
CO4: Understand methods of Data Collection, Processing and Analysis of data	

Contents –

UNIT	Topics to be covered	No. of Lecture
A	**Introduction:** Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods Verses Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Research in India.	**08**
B	**Defining the Research Problem:** What is Research Problem? Selecting the Problem, Necessity Of Defining the Problem, Techniques Involved in Defining a Problem	**10**
C	**Research Design:** Meaning of Research Design, Need of Research Design, Features of Good Design, Important Concepts Relating to Research Design, Different Research Design, Basic Principles of Experimental Designs.	**10**
D	**Sampling Design, Measurement and Scaling Techniques:** Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design. Measurement in Research, Sources of Error in Measurement, Meaning and Scaling.	**10**

E	**Methods of Data Collection, Processing and Analysis of Data:** Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Questionnaires Schedules, Processing Operations, Some Problems in Processing, Statistics in Research, Simple Regression Analysis.	**10**

Text Book : 1 C. R. Kothari, Research Methodology Methods and Techniques, New Age International Publisher, 2nd Edition
Reference Book: P. Sam Daniel, Aroma G. Sam, Research Methodology, Gyan Publishing House, 1st Edition
Course code: MCS41MEL501 **Course name:** Data Management Tools
Course category: Major Elective **Credits:** 3
Pre-requisites: Basic Knowledge of database
Course Objectives:
1. Students can design new database and modify existing ones for new or existing applications
Course Outcomes: At the end of the course, the students will be able to -
CO1: To know the different issues involved in the design and implementation of a database system.
CO2: Can use data manipulation language to query, update, and manage a database.
CO3 Essential DBMS concepts such as: database security, integrity, concurrency, etc..
CO4: To analyze data, choose relevant models and algorithms for respective applications.

Contents –

Section	Topics to be covered	No. of Lect.
A	**Unit-I:** Overview of Database Concepts: Database and Need for DBMS, Characteristics of DBMS, Database Users, 3-tier architecture,(its advantages over 2-tier), Database Components: Users, facilities & Structure, Abstraction & Data Integration, **Entity-Relationship Data model:** Entity, Entity set, Types of Entities, Attributes, Types of Attributes, Relationship, Types of Relationship, Representation of Entity, Attributes & Relationship, Keys, Types of keys Mapping Cardinality. **Introduction to SQL–** create, insert, update, delete, drop, alter, SELECT (distinct, where, and, or, not, like, between, like, order by, group by, having etc.), inner (nested) queries, aggregate functions, numeric functions, string functions, date functions, create user/role, grant/revoke privileges, views.	12

B	**Unit-II:** **Relational Database design:** Anomalies, Types of Anomalies, Functional dependencies, Integrity Rules: Rule 1 & 2 **Normalization:** Normal forms (1 NF, 2 NF, 3 NF, BCNF, 4 NF), Conversion From Universal to 1NF, 1NF to 2NF, 2Nf to 3NF. **Relational Algebra:** o Union, Intersection, difference, Cartesian Product, Selection, Projection, Join(Inner & Outer) , Division with examples	12
C	**Unit-III:** **Introduction: -** What is data mining, DBMS Vs Data Mining, DM Techniques, Challenges, Other issues, Understanding Data, DM Applications-Case Studies, Current Trends Affecting DM, Basic Data Mining Task. Relations to Database, Statistics, Machine Learning Association Rule :- What is an Association rule?, Mining, Level-wise Method, FP-Tree Method, Other Variants, A Priori Algorithm, Partition Algorithm.	12
D	**Unit-IV:** **Classification: -** Decision Tree Algorithm, CART, PUBLIC, Pruning Classification Tree, and Decision Tree, What is a decision tree? Tree Construction Principle, Best Split, Splitting indices, Splitting Criteria Web Mining: Introduction, Web Content Mining, Web Structure Mining, and Web Usage Mining.	12
E	**Unit-V:** **Clustering Techniques:** Clustering Paradigm, Partitioning Algorithm, Similarity and Distance Measure, Hierarchical Algorithm, Rough Set Theory and its Application to Data Mining **ROC Analysis:-** Data Mining Trends, Big Data, Data Analytics	12

Text Book : 1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 5th/6th Edition
2. R. Elmasri; S. Navate; Benjamin Cummings, "Fundamental of Database Systems".
3. Bipin Desai, "Database Management Systems".

Reference Book: 1. Jackson, "Relational database design for Micro computers Application", , Prentice Hall.
2. Arun K. Pujari, "Data Mining Techniques", Kindle 3rd Edition
3. M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
4. Morgan Kaufman, "Data Mining: Concepts & Techniques", 3rd Edition

Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
					External			
		L	P	Internal	ESE	PR	Total	
MCS41MEP501	Practical Based on Data Management Tools	--	**1**	**30**	**-**	**20**	**50**	**1**
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Able to create website or web based application							

Contents-

Experiment No.	Experiment Topics
1.	Creating database tables and using data types. • Create table, • Modify table, • Drop table
2.	Practical Based on Data Manipulation. • Adding data with Insert, • Modify data with Update, • Deleting records with Delete
3.	Practical Based on Implementing the Constraints.• NULL and NOT NULL, • Primary Key and Foreign Key Constraint • Unique, Check and Default Constraint
4.	Practical for Retrieving Data Using following clauses.• Simple select clause, • Accessing specific data with Where, Ordered by, Distinct and Group By with having clause
5.	Practical Based on Aggregate Functions.• AVG, • COUNT, • MAX, • MIN, • SUM, • CUBE
6.	Study various data mining tools
7.	Search and Download data set from UCI for data mining techniques and algorithms.
8.	Dealing with Missing data (Data cleaning method) in MS Excel
9.	Execute and analyze A-priori algorithm using data mining tool
10.	Execute and analyze information gain for decision tree using Data Mining tool
11.	Execute and analyze K-Means clustering algorithm using Orange or any tool.

Course code: MCS41MEL502	**Course name:** Data Structure and Algorithm
Course category: Major Elective	**Credits:** 3
Pre-requisites: Basic Knowledge of Languages	
Course Objectives:	
1. To understand the different methods of organizing large amount of data & efficiently implement the different data structures.	

Course Outcomes: At the end of the course, the students will be able to -

CO1: To use well-organized data structures in solving various problems.
CO2: To differentiate the usage of various structures in problem solution.
CO3 Implementing algorithms to solve problems using appropriate data structures.

Contents-

Section	Topics to be Covered	No. of Lectures
A	**Unit I** **Overview**: Introduction Need of Data Structure Definitions - Data and information, Data type, Data object, ADT, Data Structure Types of Data Structures ,Introduction to Algorithm, Analysis of algorithm, Space and time complexity,	05
B	**Unit II** **Array as a Data Structure** ADT of array, Operations Array applications - Searching Sequential search, variations - Sentinel search, Probability search, ordered list search Binary Search Comparison of searching methods Sorting Terminology- Internal, External, Stable, In-place Sorting Comparison Based Sorting - Lower bound on comparison based sorting, Methods- Bubble Sort, Insertion Sort, Selection Sort, Algorithm design strategies	10
C	**Unit III** **Linked List**List as a Data Structure, differences with array Dynamic implementation of Linked List, internal and external pointers Types of Linked List – Singly, Doubly, Circular Operations on Linked List - create, traverse, insert, delete, search, sort, reverse, concatenate, merge, time complexity of operations.	10
D	**Unit IV** **Stack** : Introduction Operations – init(), push(), pop(), isEmpty(), isFull(), peek(), time complexity of operations.Applications of stack	10

	Queue: Introduction Operations - init(), enqueue(), dequeue(), isEmpty(), isFull(), peek(),time complexity of operations, differences with stack. Implementation - Static and Dynamic with comparison Types of Queue - Linear Queue, Circular Queue, Priority Queue, Double Ended Queue (with implementation)	
E	**Unit V** **Graphs:** Introduction to Graph Theory, Graph isomorphism, Graph data structures: Adjacency lists, Adjacency matrices Elementary graph Algorithms: BFS, DFS, Topological sort, strongly connected Components **Trees:** Introduction to Trees, Tree traversals (preorder, inorder and postorder), Binary trees	10

Text Book : 1. Thomas Cormen, "Introduction to Algorithm" 2. Alfred V.Aho, , O'Really, "Data structures and Algorithms"
Reference Book: Ellis Horowitz, O' Reilly, "Fundamentals of Data Structures in c++"
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
		L	P	Internal	External ESE	External PR	Total	
MCS41MEP502	Practical Based on Data Structure and Algorithm	--	1	30	-	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Student get familiar with the basic concepts of data structures and algorithms. Student can implement practically searching and sorting techniques.							

List of Practicals:

Experiment No.	Experiment Topics
1	Program for traversing of n item using the array
2	Write and execute programs for push and pop operation using the stacks
3	Write and execute programs for insertion and deletion of n item from the Queues
4	Implement a program for Circular Doubly Linked List
5	Implement a program to display a Linked List.
6	Write and execute a program for binary search algorithm
7	Write and execute a program for Bubble sort Algorithm
8	Write and execute a program for implementation of insertion sort
9	Write and execute a program for demonstration of merge sort
10	Write an algorithm to sort ‘n’ number of elements using selection sort

Course code: MCS41MEL503	**Course name:** Advance Operating System
Course category: Major Elective	**Credits:** 3
Pre-requisites: Basic Knowledge of Operating System	
Course Objectives:	
1. Understand structure and organization of computer system. 2. To understand the functions of operating system which manages the computer's resources, establish a user interface, execute and provide services for applications software.	

Course Outcomes: At the end of the course, the students will be able to -

CO1: The student will analyse and evaluate computer system hardware
CO2: Understand how the Operating System establish the interface between the user and computer system.
CO3 The student will get the knowledge of different types of Managements like memory management, Processor Management, I/O Management, File management etc. done by the Operating System

Contents-

Section	Topics to be Covered	No. of Lectures
A	**Unit I** **Distributed Computing: The Parallel Computation View-I** Introduction, The fifth generation project and the strategic Computing Initiative, Super Computer Projects, Classification of sequential and Parallel Architecture, Pipelining, Vector Processing Array Preprocessors, Data Flow Computers, Multiprocessors, Fault Tolerance	9

B	**Unit II** Distributed Computing: The Parallel Computation View-II Computational Complexity Issue, Detecting Parallelism, Processor interconnection Schemes, Loosly Coupled Vs. Tightly Coupled Systems, Fetch and add, Multiprocessor Operating System Organization Scheduling Criteria, Scheduling Algorithm, Multi-Process Scheduling, Real-Time Scheduling.	9
C	**Unit III** **Disk Performance Optimization** Introduction, Operation of Moving Head Storage, Why disk Scheduling is necessary? Desirable Characteristics of Disk Scheduling Policies, Seek Optimization, Rotational Optimization, Systems Consideration, Disk Caching, Other Performance Enhancement Techniques, RAM Disks, Optical Disks	9
D	**Unit IV** **File and Database Systems- I** Introduction, The File System, File System Functions, The Data Hierarchy, Blocking and Buffering, File Organization, Queued and Basic Access Methods, Allocating and Freeing Space, File Descriptor	9
E	**File and Database Systems- I** Access Control Matrix, Access Control by User Classes, Backup and Recovery, File Servers, Distributed File Systems, CD-ROM, WORMS Magneto-Laser Disks, Database Systems, Database Models	8

Text Book : 1 H. M. Deitel Deitel & Associates, "Operating Systems", 3rd Edition
2. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", John Wiley & Sons, 6th Edition.

Reference Book: 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles" Wiley- India Publisher, 7th Edition.
2. M. Naghibzadeh, "Operating System: Concepts and Techniques" I Universe

Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		

MCS41MEP503	Practical Based on Advance Operating System		**1**	**30**		**20**	**50**	**1**
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Implementation of Algorithms							

List of Practical's:-

At least two experiments should be carried out on each unit.

Course code: MCS41MEL504	**Course name:** Cloud Computing with AWS
Course category: Major Elective	**Credits:** 3
Pre-requisites: Basic Knowledge of networking & Linux operating system	
Course Objectives:	
1 Understanding basics of cloud computing 2. Key concepts of virtualization and different cloud computing services.	

Course Outcomes: At the end of the course, the students will be able to -

CO1: Understand Cloud Computing
CO2: Understand the use of Cloud Computing
CO3: Learn the Concept of Cloud Infrastructure. Understand Business imperative of Cloud Computing
CO4: AWS – Cloud Computing basics

Contents-

Section	Topics to be Covered	No. of Lectures
A	**Unit I:** **Understanding Cloud Computing:** An Introduction to Cloud Computing, Why Cloud Computing? Components of cloud computing, Essential Characteristics of Cloud Computing **,Service Models in Cloud computing:** Public Cloud, Private Cloud, Hybrid Cloud, Community, **Cloud Deployment models in Cloud Computing:** SaaS (Software as a Service), PaaS (Platform as a Service), IaaS (Infrastructure as a Service).	09

B	**Unit II:** AWS: Amazon Web Services: Introduction to AWS, Global infrastructure of AWS, Region, Availability Zone, Edge Locations,AWS Platform. **Cloud Domain**: Security& Identity Compliance, Compute domain, Storage domain, Network and Content Delivery, Database domain.	08
C	**Unit III:** **Identity Access Management (IAM):** Introduction to IAM, Root User, IAM user, Multi Factor Authentication for Users, IAM Password Policies, Access Key ID and Secret Access Key, AWS Managed Policies, Customer Managed Policies.	
D	**Unit IV:** **Amazon Elastic Compute Cloud (Amazon EC2):** Introduction to EC2, EC2 Vs Traditional Computing, EC2 Instance Life-Cycle**,** Launching a Windows Instance, Launching a Linux Instance, Security Groups, **EC2 Instance Types:** On-Demand Instances, Reserved Instances, EC2 Vertical Scaling & Horizontal Scaling,	10
E	**Unit V:** Amazon Simple Storage Service (S3): Introduction to S3, Object based storage Vs File System Storage, Storage Classes, Versioning, Access Control Lists, Cross-region replication, S3 storage automation with Life Cycle Management. **Virtual Public Cloud(VPC):** Introduction VPC, **Networking Basics:** IPv4 Classes, Public IP Vs Private IP, Subnets, NAT. **VPC Basics:** Default VPC, Custom VPC	09

Text Book : 1 Miller, "Cloud Computing", Pearson Education India 2. Pandey U.S. &Chaudhary Kavita, "Cloud Computing", S. Chand Publishing
Reference Book: 1. Mark Wilkins, "Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud**"** **2.** Ben Piper, David Clinton, "AWS Certified Solutions Architect Study Guide Ben Piper,David Clinton", 3rd Edition.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MEP504	Practical Based on Cloud Computing with AWS		1	30		20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	• Understanding basics of cloud computing. • Key concepts of virtualization and different cloud computing services. • AWS – Cloud computing basics.							

List of Practicals:

Experiment No.	Experiment Topics
1	Study of cloud computing & Architecture.
2	Hands on Activity for virtual box Installation.
3	Study cloud Deployment Model in details.
4	Study of Identity Access Management (IAM).
5	Create User, Group, and Policies & Role using IAM.
6	Study of EC2? Create one windows EC2 instance and Login to the Windows EC2 Instance.
7	Create a Linux EC2 Instance and Login to the Linux EC2 Instance.
8	Create a Linux EC2 instance and Host a simple Website.

9	Study of S3 services & S3 life cycle rule.
10	Create S3 bucket in any region and upload any object to the S3 bucket.
11	Study of Virtual Private Network.

Semester: SECOND

Course code: MCS41MML504	**Course name:** Pattern Recognition
Course category: Major Mandatory	**Credits:** 3
Pre-requisites: Basic Knowledge of networking & Linux operating system	
Course Objectives:	
To provide the general mechanism and design of Automatic system recognition.	

Course Outcomes: At the end of the course, the students will be able to -

CO1: Understands basic structure of pattern recognition systems
CO2: Defines the relationship between pattern and feature.
CO3: Explains supervised and unsupervised pattern recognition approaches.

Contents-

Section	Topics to be covered	No. of Lect.
UNIT I:	**Introduction to Pattern Recognition, Bayesian decision theory:** Classifiers,Discriminantfunctions,Decisionsurfaces,Normaldensityand Discriminant functions, discrete features	**08**
UNIT II:	**Maximum Likelihood and Bayesian Estimation:** Parameter estimation methods, Maximum- Likelihood estimation, Bayesian estimation, Bayesian Parameter Estimation, Gaussian Case, General Theory, Problem of Dimensionality, Accuracy, Dimension, and Training Sample Size, Computational Complexity and Overfitting, Component Analysis and Discriminants, Principal Component Analysis (PCA), Expectation Maximization (EM), Hidden Markov models for sequential pattern classification, First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation, Evaluation, Decoding and Learning.	**10**
UNIT III:	**Non-parametric :** Density estimation, Parzen-window method, Probabilistic Neural Networks (PNNs), K-Nearest Neighbour, Estimation and rules, Nearest Neighbour and Fuzzy Classification. Linear Discriminant function based classifiers: Perceptron, Linear Programming Algorithm, Support Vector Machines (SVM)	
UNIT IV:	**Multilayer Neural Network**: Feed Forward Classification, Back Propagation Algorithm, Error Surface Stochastic Data: Stochastic search, Boltzmann Learning, Evolutionary method and Genetic Programming.	**08**
UNIT V:	**Non-metric methods for pattern classification**: Decision trees, Classification and Regression Trees (CART) and other tree methods, String recognition and Rule Based method. Unsupervised learning and clustering : Mixture Densities and Identifiability, Maximum Likelihood estimation, Application Normal Mixture, Unsupervised Bayesian Learning, Data Description and Clustering, Hierarchical Clustering, Graph theory method, Problem of validity, Component analysis	**10**

Book Text: 1 R.O.Duda,P.E.HartandD.G.Stork, "PatternClassification" JohnWiley,2007 2nd Edition
Reference Book: 1. ChristopherM.Bishop, "NeuralNetworkforPatternRecognition" OxfordOhioPress
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MMP504	Practical Based on Pattern Recognition	-	1	30	-	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Extraction of patterns from the input data and analysis of the data							

List of Practical's:-

At least two experiments should be carried out on each unit.

Course code: MCS41MML505	**Course name:** Data Mining and Visualization
Course category: Major Mandatory	**Credits:** 3
Pre-requisites: Basic knowledge of Data Science	
Course Objectives:	
1 Students will be able to actively manage and participate in data mining projects. To develop research interest towards advances in data mining 2..Students will be able to understand the visualization techniques	

Course Outcomes: At the end of the course, the students will be able to -

CO1: Understand the Data Mining
CO2: Understand How to Explore Data
CO3: Understand Classification
CO4: Understand Classification Techniques

Contents-

Section	Topics to be covered	No. of Lect.
A	**UNITI:** Introduction to Data Mining: Why Mine Data? Commercial Viewpoint, ScientificViewpoint Motivation, Definitions, Origins of Data Mining, Data Mining Tasks, Classification, Clustering, Association Rule Discovery, Sequential Pattern Discovery, Regression, Challenges of DataMining,DataMiningData:WhatisData?Attribute Values,MeasurementofLength,TypesandPropertiesofAttributes, Discrete and Continuous Attributes, Types of data sets, Data Quality, Data Preprocessing, Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Attribute Transformation, Density	**09**
B	**UNITII:** Data Mining: Exploring Data: Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Visualization, Representation, Arrangement,Selection,VisualizationTechniques:Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Other Visualization Techniques, OLAP : OLAP Operations, Data Mining Classification: Bask Concepts, Decision Trees, and Model Evaluation: Classification: Definition,ClassificationTechniques,TreeInduction,Measures ofNodeImpurity,PracticalIssuesofClassification,ROCcurve, Confidence Interval for Accuracy, Comparing Performance of Two Models, Comparing Performance of Two Algorithms.	**09**

C	**Unit III** Data Mining Association Analysis: Basic Concepts and Algorithms: Association Rule Mining, Frequent Item set Generation, Association Rule Discovery : Hash tree, Factors Affecting Complexity, Maximal Frequent Horible Closed Itemset, Alternative Methods for Frequent Item set Generation, FP growth Algorithm, Tree Projection, Rule Generation, Pattern Evaluation, Statistical Independence, Properties of A Good Measure, Support-based Pruning, Subjective Interestingness Measure.	**09**
D	**Unit IV** DataMiningClusterAnalysis:BasicConceptsand Algorithms: Applications of Cluster Analysis, Types of Clusters, Clustering Algorithms: K- means and itsvariants,Hierarchicalclustering,Densitybasedclustering.Graph-BasedClustering, Limitations of Current Merging Schemes, Characteristics of Spatial Data Sets, Shared Near Neighbor Approach, ROCK (Robust Clustering using linKs), Jarvis-Patrick Clustering, SNN Clustering Algorithm, Data Mining Anomaly Detection: Anomaly/Outlier Detection, Importance, Anomaly Detection Schemes, Density-based: LOF approach.	**09**
E	**UNITV:** IntroductiontoDataVisualization – Classification of Visualization techniques – Structure and representation – Selection of a Visualization – Visualizations for high dimensional data – Graphics and computing, Principles of Data Visualization : Multivariate data – Linked data – Visualizing trees and forests – Large Datasets – Plots and their variates – Visualizing cluster analysis – contingency tables – finite mixture models, Methodologies: Visualization inBayesian data analysis – Matrix visualization – Data visualization by kernel machines .Applications : Visualization for genetic network reconstruction, medical images, financial dataset and Insurance risk processes.	**09**

Book Text: 1 Tan, Steinbach, Kumar. "IntroductiontoDataMining"
2. Jiawei Han, MichelineKamber, "DataMining:Conceptsand Techniques" Morgan Kaufmann Publishers
3. C.R.Rao, "PrinciplesofDataMining", North Holland

Reference Book: 1. Usama Fayyad,,Georges G., Grinstein and Andreas Wierse, "Information visualization in Data Mining and Knowledge discovery" Morgan kaufmann publishers, 2002
Chun-houhChen,
2.Wolfgang Hardleand Antony Unwin, "HandbookofDataVisualization" Springer, 2008

Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MMP505	Practical Based on Data Mining and Visualization	--	1	30	-	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Identify appropriate datamining algorithms to solve real world problems							

List of Practical's:-

Sr.No	List of Practical
1.	Demonstration of preprocessing ondataset student.arff
2.	Demonstration of preprocessing ondataset labor.arff
3.	Demonstration of Association ruleprocess on dataset contactlenses.arffusingapriori algorithm
4.	Demonstration of Association ruleprocess on dataset test.arff using apriorialgorithm
5.	Demonstration of classification rule process on dataset using Nearest neighbor algorithm
6.	Demonstration of classification rule process on dataset using K-NN algorithm
7.	Demonstration of classification rule process on dataset using Decision tree algorithm
8.	Demonstration of classification rule process on dataset using Regression algorithm
9.	Apply Visualization techniques for Various Dataset
10.	Apply Visualization techniques for Various Dataset
11	Apply Visualization techniques for Various Dataset

Course code: MCS41MML506	**Course name:** Python Programming
Course category: Major Mandatory	**Credits:** 3

Pre-requisites: Basic knowledge Programming

Course Objectives:

1 Building robust applications using Python programming language's features.
2.. Understanding the usage of Python libraries.

Course Outcomes: At the end of the course, the students will be able to -

CO1:	Understand python programs that solve simple business problems.
CO2:	Error Handling in python, pandas, Jupyter, Notebook. Plot and data visualization
CO3:	Missing Data Identification and understanding
CO4:	Business Data predication tool design

Contents-

Section	Topics to be covered	No. of Lect.
A	**UNIT 1** IPython: Beyond Normal Python: Shell or Notebook?, Launching the IPython Shell, Launching the Jupyter Notebook, Help and Documentation in IPython, Accessing Documentation with?, Accessing Source Code with ?, Exploring Modules with Tab Completion, Keyboard Shortcuts in the IPython Shell, Navigation Shortcuts, Text Entry Shortcuts, Command History Shortcuts, Miscellaneous Shortcuts, IPython Magic Commands, Pasting Code Blocks: %paste and %cpaste, Running External Code: %run, Timing Code Execution: %timeit, Help on Magic Functions: ?, %magic, and %lsmagic, Input and Output History, IPython's In and Out Objects, Underscore Shortcuts and Previous Outputs, Suppressing Output, Related Magic Commands, IPython and Shell Commands, Quick Introduction to the Shell, Shell Commands in IPython, Passing Values to and from the Shell, Shell-Related Magic Commands, Errors and Debugging, Controlling Exceptions: %xmode, Debugging: When Reading Tracebacks Is Not Enough, Profiling and Timing Code, Timing Code Snippets: %timeit and %time, Profiling Full Scripts: %prun, Line-by-Line Profiling with %lprun, Profiling Memory Use: %memit and %mprun	10
B	**UNIT 2** Introduction to NumPy: ○ Understanding Data Types in Python, A Python Integer Is More Than Just an Integer, A Python List Is More Than Just a List, Fixed-Type Arrays in Python, Creating Arrays from Python Lists, Creating Arrays from Scratch, NumPy Standard Data Types, The Basics of NumPy Arrays, NumPy Array Attributes, Array Indexing: Accessing	10

	Single Elements, Array Slicing: Accessing Subarrays, Reshaping of Arrays, Array Concatenation and Splitting, Computation on NumPy Arrays: Universal Functions, The Slowness of Loops,IntroducingUFuncs, Exploring NumPy'sUFuncs, Advanced Ufunc Features, Ufuncs:Aggregations: Min, Max, and Everything in Between, Summing the Values in an Array, Minimum and Maximum, Computation on Arrays: Broadcasting, Introducing Broadcasting, Rules of Broadcasting, Broadcasting in Practice,Comparisons, Masks, and Boolean Logic, Example: Counting Rainy Days, Comparison Operators as ufuncs, Working with Boolean Arrays, Boolean Arrays as Masks, Fancy Indexing, Exploring Fancy Indexing, Combined Indexing, Example: Selecting Random Points, Modifying Values with Fancy Indexing, Example: Binning Data, Sorting Arrays, Fast Sorting in NumPy: np.sort and np.argsort, Partial Sorts: Partitioning, Example: k-Nearest Neighbors, Structured Data: NumPy's Structured Arrays, Creating Structured Arrays, More Advanced Compound Types.	
C	**UNIT 3** Data Manipulation with Pandas: Installing and Using Pandas Introducing Pandas Objects, The Pandas Series Object, The Pandas DataFrame Object, The Pandas Index Object, Data Indexing and Selection, Data Selection in Series, Data Selection in DataFrame, Operating on Data in Pandas, Ufuncs: Index Preservation, UFuncs: Index Alignment, Ufuncs: Operations Between DataFrame and Series, Handling Missing Data, Trade-Offs in Missing Data Conventions, Missing Data in Pandas, Operating on Null Values, Hierarchical Indexing, A Multiply Indexed Series, Methods of MultiIndex Creation, Indexing and Slicing a MultiIndex,	10
D	**UNIT 4** Rearranging Multi-Indices: o Data Aggregations on Multi-Indices, Combining Datasets: Concat and Append, Recall: Concatenation of NumPy Arrays, Simple Concatenation with pd.concat, Combining Datasets: Merge and Join, Relational Algebra, Categories of Joins, Specification of the Merge Key, Specifying Set Arithmetic for Joins, Overlapping Column Names: The suffixes Keyword, Example: US States Data, Aggregation and Grouping, Planets Data, Simple Aggregation in Pandas, GroupBy: Split, Apply, Combine, Pivot Tables, Motivating Pivot Tables, Pivot Tables by Hand, Pivot Table Syntax, Example: Birthrate Data, Vectorized String Operations, Introducing Pandas String Operations, Tables of Pandas String Methods, Example: Recipe Database, Working with Time Series, Dates and Times in Python, Pandas Time Series: Indexing by Time, Pandas Time Series Data Structures, Frequencies and Offsets, Resampling, Shifting, and Windowing, Where to Learn More, Example: Visualizing Seattle Bicycle Counts, High-Performance Pandas: eval() and query(), Motivating query() and eval(): Compound Expressions, pandas.eval() for Efficient	10

	Operations, DataFrame.eval() for Column-Wise Operations, DataFrame.query() Method	
E	UNIT 5 **Visualization with Matplotlib**: General MatplotlibTips,Importingmatplotlib, Setting Styles, show() or No show()? How to Display Your Plots, Saving Figures to File, Two Interfaces for the Price of One, Simple Line Plots, Adjusting the Plot: Line Colors and Styles, Adjusting the Plot: Axes Limits, Labeling Plots, Simple Scatter Plots, Scatter Plots with plt.plot, Scatter Plots with plt.scatter, plot Versus scatter: A Note on Efficiency, Visualizing Errors, Basic Errorbars, Continuous Errors, Density and Contour Plots, Visualizing a Three-Dimensional Function, Histograms, Binnings, and Density, Two-Dimensional Histograms and Binnings, Customizing Plot Legends, Choosing Elements for the Legend, Legend for Size of Points, Multiple Legends, Customizing Colorbars, Customizing Colorbars, Example: Handwritten Digits, Multiple Subplots, plt.axes: Subplots by Hand, plt.subplot: Simple Grids of Subplots, plt.subplots: The Whole Grid in One Go, plt.GridSpec: More Complicated Arrangements, Text and Annotation, Example: Effect of Holidays on US Births, Transforms and Text Position, Arrows and Annotation, Customizing Ticks, Major and Minor Ticks, Hiding Ticks or Labels, Reducing or Increasing the Number of Ticks, Three-Dimensional Plotting in Matplotlib 290 Three-Dimensional Points and Lines	05

Book Text: 1 Jake VanderPlas, "Python Data Science Handbook Essential Tools for Working with Data" O'Reilly 1st Edition

2. Gowrishankar S, Veena A, "Introduction to Python Programming" CRC Press/Taylor

3. AurelienGeron, " Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" O'Reilly, 1st Edition

Reference Book: 1. Wesley J Chun, "Core Python Applications Programming" Pearson 3rd Edition

2. Miguel Grinberg, "Flask Web Development: Developing Web Applications with Python" O'Reilly, 2nd Edition

Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MMP506	Practical Based on Python Programming		1	30		20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	• **Building robust applications using Python programming language's features, Understanding the usage of Python libraries.**							

List of Practicals:

Experiment No.	Experiment Topics	
1	Installing Python and Shell or Notebook?, Launching the IPython Shell, Launching the Jupyter Notebook	L1
2	Passing Values to and from the Shell, Shell-Related Magic Command, Errors and Debugging, Controlling Exceptions: %xmode	L1
3	Aggregations: Min, Max, and Everything in Between, Summing the Values in an Array, Minimum and Maximum, Example: What Is the Average Height of US Presidents?	L2
4	Sorting Arrays, Fast Sorting in NumPy: np.sort and np.argsort, Partial Sorts: Partitioning, Example: k-Nearest Neighbors	L2
5	Data Indexing and Selection, Data Selection in Series, Data Selection in DataFrame, Operating on Data in Pandas, Ufuncs: Index Preservation, UFuncs: Index Alignment	L3
6	Handling Missing Data, Trade-Offs in Missing Data Conventions, Missing Data in Pandas, Operating on Null Values	L3
7	Vectorized String Operations , Introducing Pandas String Operations, Tables of Pandas String Methods, Example: Recipe Database	L4
8	General Matplotlib Tips, Importing matplotlib, Setting Styles, show() or No show()? How to Display Your Plots, Saving Figures to File	L4
9	Text and Annotation, Example: Effect of Holidays on US Births, Transforms and Text Position, Arrows and Annotation, Customizing Ticks, Major and Minor Ticks, Hiding Ticks or Labels, Reducing or Increasing the Number of Ticks	L5

10	Three-Dimensional Plotting in Matplotlib, Three-Dimensional Points and Lines, Three-Dimensional Contour Plots	L5

Course code: MCS41MEL505	**Course name: Intellectual Property Rights**
Course category: Major Elective	**Credits: 3**
Pre-requisites: Basic knowledge Research	
Course Objectives:	
1 . To make patent copyright, trademark application process known	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand Indian Patent Law	
CO2: To understand Patent Data basis and Patent Information System	
CO3: To Understand Preparation of Patent Documents	
CO4: Understand the application procedure of patenting	

Section	Topics to be Covered	No. of Lectures
A	**Unit I** **Indian Patent Law:** Concept of Patent, Product / Process Patents & Terminology, The Patents Act, Amendments to the Patents Act, Patent Rules, Patentable Subject Matter and Patentability Criteria, Duration of Patents - Law and Policy Consideration, Elements of Patentability - Novelty and Non Obviousness, Procedure for Filing of Patent Application and Types of Applications, Procedure for Opposition, Revocation of Patents, Ownership and Maintenance of Patents, Assignment and Licensing of Patents, Assignments of Patents, Working of Patents- Compulsory Licensing, Revocation of Patents by the Controller for Non-Working, Procedure in Respect of Compulsory License, International Applications, Patent Agent-Qualification and Registration Procedure.	09
B	**Unit II** **Patent Data basis and Patent Information System:** Patent Offices in India, Patent Information, What is Patent Information, Reasons for Using Patent Information, Patent Search & Patent Databases, Databases on CD-Rom, On-line Databases, Various Types of Searches using Patent Documentation, Pre-Application Searches (PAS), State-of-the-Art Searches, Novelty Searches, Patentability or Validity Searches, Name Searches , Technological Activity Searches, Infringement Searches, Patent Family Searches, Legal Status Searches.	09

C	**Unit III** **Preparation of Patent Documents:** Lab Notebooks/Log Books/Record Books, Methods of Invention Disclosure, Provisional Specification, Complete Specification, Patent Application and its Contents, Contents of Patent Application, Writing of Patent Document, Preparing Patent Applications, Obtaining Invention Disclosures from Inventors, Identifying Patentable Inventions, Understanding the Invention, Typical Parts of the Patent Application, Claims, Detailed Description or Specification, Detailed Description or Specification, Detailed Description or Specification, Abstract, Summary	09
D	Unit IV Process of Examination of Patent Application: Publication of Patent Application, Request for Examination, Request for Examination, Allocation of Application to examiner for examination, Examination of Patent Application: Regulatory Regime, Formal examination, Substantive Examination, Understanding the invention, Sufficiency of Disclosure: Technical or Specialized Terms, Scope of Claims, Scope of Claims, Scope of Claims, Single Inventive Concept, Patentability Criterion novelty, inventive step, industrial applicability, Prior Public Use, Prior Claiming, Industrial Applicability, Re-Issue and Re-Examination.	09
E	Unit V **Patent Infringement**: What Amounts to Patent Infringement, Types of Patent Infringement, Damages and Accounts for Profits. Trade Mark: Registration of Trade Marks, Registration Procedure. **Copyright:** Nature of Copyright Protection, Copyright Pertaining to Software, Term of Copyright, Registration of Copyright. **Industrial Designs:** What is a Design? Application and Registration of Design, Priority Document, Representation Sheet. Geographical Indications, Lay-Out Designs of Integrated Circuits, The Protection of Plant Varieties and Farmers Rights.	09

Book Text: 1 "Intellectual property propertyproperty rights- rights-laws and practice" The institute of company secretaries of india, Module 3 elective paper 9.3
2 NirajPanday,K D, "Intellectual property rights" PHI learning PVt ltd, 2014

Reference Book: 1. Chintakunta, Ramakrishna &Meka, Geethavani, "A textbook of intellectual property rights" 2022
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MEP505	Practical Based on Intellectual Property Rights	--	1	30	--	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								

List of Practicals:

At least two experiments should be carried out on each unit.

Course code: MCS41MEL506	**Course name:** React JS
Course category: Major Elective	**Credits: 3**
Pre-requisites: knowledge of web development and JavaScript	
Course Objectives:	
1. To build an interactive user interfaces and web applications quickly and efficiently with significantly less code	

Course Outcomes: At the end of the course, the students will be able to -

CO1: Enable developers to develop large web applications which can change data, without reloading the page
CO2: Simplified Scripting
CO3: Component-based architecture.
CO4: Stable Code Structure

Contents-

Section	Topics to be covered	No. of Lect.
A	**UNITI:** What is React?, React version history, anatomy of React project, working with React, Create element, Expressions, using logical operators, specifying attributes, significance of component architecture, Types of component, Component Composition	**08**
B	**UNITII:** Working with state and props What is state and its significance, Read state and Set state, Passing data to component using props, validating props using prop types, using React key prop, Understanding React event system	**10**
C	**UNITIII:** **Working with forms</str** Controlled components, Uncontrolled Components, Understand the significance to default Value prop, What is context?, When to use context, Create Context, Context Provider, Context Consumer, Reading context in class	**10**
D	**UNIT IV:** **Code-Splitting :** What is code splitting, why do you need code splitting, React lazy, Suspense Route-based code splitting, What are hooks, why do you need hooks, different types of hooks, using state and effect hooks, rules of hooks	**08**

E	**UNITV:** **Templating using JSX** Working with React, Create Element, Expressions, Using Logical Operators, Specifying attributes, Specifying children, Fragments, Understand the significance of unit testing	**10**

Book Text: 1 Karl Rippan, "Learn React with typescript: Beginner's Guide to reactive" Edition 2
Reference Book: 1. Adam Boduch, Roy Derks, "React and React Native", Edition 4
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MEP506	Practical Based on React JS	--	1	30	--	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Identify appropriate datamining algorithms to solve real world problems							

List of Practicals:

At least two experiments should be carried out on each unit.

Course code: MCS41MEL507	**Course name:** Neural Network
Course category: Major Elective	**Credits: 3**
Pre-requisites: Basic understanding of Digital Image Processing and Pattern Recognition	
Course Objectives:	
Identify different neural network architectures, algorithms, applications, and their limitations.	

Course Outcomes: At the end of the course, the students will be able to -

CO1: Develop the skill in basic understanding on neural network.
CO2: Explore the Advanced methods of representing information in NN.
CO3: Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications

Contents-

Section	Topics to be Covered	No. of Lectures
A	**Unit I** **Introduction:** Fundamentals of neural networks, Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Taxonomy of Neural network architectures, Knowledge representation. Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules	09
B	**Unit II** **Supervised Neural Networks:** Standard back propagation algorithms, selection of various parameters, variations Applications of back propagation algorithms **Single Layer Perceptron:** functionality, libraries for SLP,Linear binary classifier, parts of perceptron, Perceptron convergence theorem, Method of steepest descent - least mean square algorithms, advantages, disadvantages	09
C	**Unit III** **Supervised Neural Networks:** **Multi layer Perceptron:** Effect of tuning parameters of the back propagation neural network. Selection of various parameters in BPN, Variations of standard back propagation algorithm, what are hidden layers, Derivation of the back-propagation algorithm, weights, activation's, network of neurons, training networks, Learning Factors, predictions, advantages and disadvantages.	
D	**Unit IV** **Radial Basis and Recurrent Neural Networks:** RBF network structure, RBF neurons, theorem and the reparability of patterns, RBF learning strategies, Training the RBNF, Advantages of RBNF, K-means and LMS algorithms, comparison of RBF and MLP networks, Hopfield networks: energy function, spurious states, error performance .	09

E	**Unit V** **Unsupervised Neural Networks:** Adaptive Resonance Theory: Introduction, ART1, ART2, Kohonen Neural Network: Self-Organizing Feature Map, Learning Vector Quantization.	09

Book Text: 1 Simon Haykin, "Neural Network a – Comprehensive Foundation" Pearson Education 2. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", **Addison Wesley, 2003**
Reference Book: 1. Zurada J.M, "Introduction to Artificial Neural Systems" Jaico publishers 2 S. Rajasekaran, and G. A. VijayalakshmiPai, "Neural Networks, Fuzzy Logic, & Genetic AlgorithmsSynthesis& Applications", PHI
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MEP507	**Practical Based on Neural Network**	--	**1**	**30**		**20**	**50**	**1**
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	To **Understand** basic neuron models and learning algorithms by using Matlab's neural network toolbox, To **Describe** about different activation function (transfer function), To **Analyze** how weights & bias values affect the output of neuron, To **Identify** how weights & bias values are able to represent a decision boundary in the feature space, To **Conceptualize** about perceptron learning rule works for linearly separable problems.							

List of Practicals:

Experiment No.	Experiment Topics
1	To study MATLAB software and its toolboxes.
2	Write a program to implement MP Model.
3	Write a program for solving linearly separable problem using Perceptron Model.
4	Write a program for pattern classification using Perceptron Model
5	With a suitable example demonstrate the perceptron learning law with its decision regions using MATLAB. Give the output in graphical form
6	With a suitable example simulate the perceptron learning network and separate the boundaries. Plot the points assumed in the respective quadrants using different symbols for identification
7	Write a program for XOR function (binary input and output) with momentum factor using back propagation algorithm.
8	Write a MATLAB program to show Back Propagation Network for XOR function with Bipolar Input and Output
9	Write a program to store a pattern (1 1 1 0). Test the network using Discrete Hopfield Net by giving the input with mistakes in First and Second position
10	Program for Pattern storage of 10 digits with Discrete Hopfield Network

Course code: MCS41MEL508	**Course name:** Ethics and Cyber Security
Pre-requisites: Basic understanding of Digital Image Processing and Pattern Recognition	
Course Objectives:	
1. Identify Key concept and Terminology of Cyber Security. 2. Examine the concept of privacy and its legal protections. 3. Explain the primary concepts involving encryption. 4. Describe the social implications of cyber security. 5.Understand the risks and benefits of social networks.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: To understand fundamental cyber security concepts	
CO2: Explain technical and non-technical security solutions on different types of cyber systems.	
CO3: Identify attributes associated with cyber security professionals.	

Contents-

Section	Topics to be Covered	No. of Lectures
A	**Unit 1** Introduction to Cyber Security and its Challengesin cyber securityOverview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats: - Cyber Warfare-Cyber Crime-Cyber Terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.	**09**
B	**Unit 2** Cyber Security Vulnerabilities and attacks Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.	**09**
C	**Unit 3** Securing Web Application, Services and ServersIntroduction, Basic security for HTTP Applications and Services, Basic Security for SOAPServices, Identity Management and Web Services, Authorization Patterns, SecurityConsiderations, Challenges.	**09**
D	**Unit 4** Cryptography and Network Security Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography.	**09**
E	**Unit 5** Cyberspace and the Law	**09**

	Introduction, Cyber Security Regulations, Roles of International Law, the state and PrivateSector in Cyberspace, Cyber Security Standards.The INDIAN Cyberspace, National CyberSecurity Policy 2013.	

Book Text: 1 Yuri Diogenes (Author), ErdalOzkaya (Author)' "Cyber security – Attack and Defense Strategies" Paperback, 2nd Edition
Reference Book: 1. Franke, Don, "Cyber Security Basics: Protect your organization", Paperback, 2nd Edition.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
				Internal	External		Total	
		L	P		ESE	PR		
MCS41MEP508	Practical Based on Ethics and Cyber Security		1	30		20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								

List of Practicals:

Experiment No.	Experiment Topics
1	1: Cyber Security Posture: Students conduct an 'audit' of their current cyber security behavior and readiness. Thisincludes questions related to their computing devices (e.g., type, OS, version, securitysoftware installed, etc.), what files they back up, their home network configuration andhow they decide to connect to WiFi networks outside of the home, passwordmanagement, and social networking.
2	2: Understanding and Using Cryptography: Students install software to learn both encryption and steganography. For this variousfree software can be downloaded that provides full disk encryption, file encryption,and steganography. Students are asked to take screen shots of their activities, encodea message hidden within an image and send it to the instructor, as well as decode amessage hidden in an image from the instructor.
3	3: Understanding the Threat Landscape: Students need to install anti-malware software and run a comprehensive scan on theircomputer. This includes downloading and installing free anti-malware oftware thatworks with their primary computing device (links are provided), runningcomprehensive scans of their computer with this software, taking a screen shot of theresults, and answering several questions about different types of malware, historicalexamples of each type of malware, and what it does to a system.
4	4: Digital Forensics, Data Recovery, and Data Protection: Students install software that automatically backs up their computer as well assoftware that allows them to recover previously deleted files. This includesdownloading and installing CrashPlan (local backup is free) and PhotoRec (free photoand file recovery tool). Students can be asked to use the photo and file recovery tooland identify anything interesting they found from the scan, including previouslydeleted files and files they did not know ever existed on their computer in the firstplace.
5	5: Privacy, Social Media, and Anonymity on the Web : Students install https everywhere, the Tor browser, learn about anonymous email

	services, and research how well they really know their Facebook/any socialcommunication site friends. This includes visiting a few web sites and noting whetheror not https is used, then installing https everywhere on compatible browsers andvisiting those same websites again. Generally speaking, students should now see that https is being used, when possible. With respect to their Facebook/ any social communication site friends, students had to identify the first 25 friends on their friends24list, how long they have known each of them, how well they know each of their friends,whether or not they met this friend in-person prior to becoming friends on Facebook/any social communication site, when they last saw this friend in-person (if ever), thelast time they spoke to this person on the phone (if ever), and how close of friends theyare with each person.
6	6: Managing Passwords : Students download and install a password manager and configure it appropriately foruse. This includes deciding on a password manager that will suit their particular needsand answering several questions about authentication techniques, including thedifferent factors and what is meant by two-factor authentication.
7	7 : Break A Caesar Cipher : Caesar cipher is a type of encryption method that was first used by Julius Caesar to communicate with his officials. This encryption technique is also considered to be oneof the first methods which are still effective. The concept of Caesar cipher is simple — a letter of a given text is replaced by anotherletter that comes after a number of other alphabets. For example — Test: Apple | Shift:5 | Ciphertext: FUUQJ. To build a small web app that can break Caesar cipher.
8	8 : Packet Sniffing : Packet Sniffing, which is also known as network traffic analysis is all about taking alook at data packets that are sent across the internet and moves on your network. There are several tools available that capture packets such as tcpdump, Windump, Wireshark etc that can be used for packet sniffing.
9	Build a small application as a example of steganography.

Semester: THIRD

Syllabus
Semester III

Course code:MCS41MML601	**Course name:** Computer Vision	**Course category:** Major Mandatory
Credits: 3	**Teaching scheme:** L-3 P-0	**Evaluation scheme:** CA–60, ESE–40
Pre-requisites:. Student must have knowledge of Signal Processing, Image Processing, Neural Networks and Artificial Intelligence		
Course Objectives: Provide the mechanics for representation and analysis of Multispectral data		
Course Outcomes: At the end of the course, the students will be able to -		
CO1. Understand the fundamental concepts and principles of computer vision, including image formation, feature extraction, and image processing techniques.		
CO2. Gain proficiency in using popular computer vision libraries and tools such as OpenCV, TensorFlow, and PyTorch for image processing and analysis.		
CO3. Develop skills in implementing various computer vision algorithms, including object detection, segmentation, classification, and tracking.		
CO4. Prepare for further study or career opportunities in fields related to computer vision, such as machine learning, artificial intelligence, computer graphics, and image processing.		
CO5. Understand the ethical considerations and potential biases involved in computer vision applications, and learn strategies for responsible deployment and usage.		

Contents

Unit	Topics to Covered	Teaching Hours
1	**CAMERAS:** Pinhole Cameras, Perspective Projection, Affine Projection, GEOMETRIC CAMERA MODELS:Elements of Analytical Euclidean Geometry, Coordinate Systems and Homogeneous Coordinates,Coordinate System Changes and Rigid Transformations, Camera Parameters and the Perspective Projection, Intrinsic Parameters, Extrinsic Parameters, A Characterization of Perspective Projection Matrices, Affine Cameras and Affine Projection Equations, Affine Cameras, A Characterization of Affine Projection Matrices, GEOMETRIC CAMERA CALIBRATION: Least-Squares Parameter Estimation, Linear Least-Squares Methods, Nonlinear Least Squares Methods, A Linear Approach to Camera Calibration, Estimation of the Projection Matrix, Estimation of the Intrinsic and Extrinsic Parameters	**08**
2	**RADIOMETRYMEASURINGLIGHT:** Light in, Foreshortening, Solid Angle, Radiance, Light at Surfaces, Simplifying Assumptions, The Bidirectional Reflectance Distribution Function, Example: The Radiometry of Thin Lenses, Important Special Cases, Radiosity, Directional Hemispheric Reflectance, Lambertian Surfaces and Albedo, Specular Surfaces, The Lambertian + Specular Model.	**09**
3	**SOURCES, SHADOWS, ANDSHADING:** Qualitative Radiometry, Sources and Their Effects, Radiometric, Properties of Light Sources, Point Sources, Line Sources, Area Sources, Local Shading Models, Local Shading Models for Point Sources, Area Sources and Their Shadows, Ambient Illumination COLOR:ThePhysicsofColor,RadiometryforColoredLights:SpectralQuantities,TheColorofSources,TheColorofSurfaces,HumanColorPerception,ColorMatching,ColorReceptors,RepresentingColor,LinearColorSpaces,Non –linear Color Spaces, Spatial and Temporal Effects,	**08**

4	**LINEAR FILTERS:** Linear Filters and, Convolution, Shift Invariant Linear Systems, Discrete Convolution, Continuous Convolution., Edge Effects in Discrete Convolutions, Spatial Frequency and Fourier Transforms, Fourier Transforms, Sampling and Aliasing, Sampling, Aliasing, Smoothing and Resampling **TEXTURE:** Representing Texture, Extracting Image Structure with Filter Banks, Representing Texture Using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids, The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids	**10**
5	**STEREOPSIS:** Reconstruction, Image Rectification, Human Stereopsis, Binocular Fusion, Correlation, Multi-Scale Edge Matching, Using More Cameras Three Cameras, Multiple Cameras **IMAGE BASED RENDERING:** Constructing 3D-Model from Image Sequences, Scene Modeling from Registered Images, Scene Modeling from Unregistered Images, Transfer-Based Approaches to Image-Based Rendering, Affine View Synthesis, Euclidean View Synthesis, The LightField	**10**

Text Book:

1. ComputerVision:AModernApproach,ForsythPonce,PearsonEducation
2. ImageProcessing,AnalysisandMachineVision,MilanSonka,ThomsonLearning

Reference Book:

1.Machine Vision, Jain R C Kasturi R, McGrawHill

2.Three Dimensional Computer Vision, Y Shirai, Springer Verlag

3. Computer And Robot Vision Vo I and II, Haralick R M And Shapiro L G, Addison Wesley

Online Resources: 1.NPTEL - Computer Vision: Concepts and Applications

2. SWAYAM - Computer Vision: Basics and Applications

Syllabus
Semester III

Course Code: MCS41MMP601 **Course name**: Practical Based on Computer Vision **Course Category**: Major Mandatory Credits: 1 Teaching scheme: L-0 P-2 Evaluation scheme: CA–30, ESE–20
Pre-requisites: Basics of mathematics
Course Objectives: Prepare for further study or career opportunities in fields related to computer vision, such as machine learning, artificial intelligence, computer graphics, and image processing.
Course Outcomes: At the end of the course, the students will be able to –
CO1. Understand the basic concepts of image processing and computer vision
CO2. Analysis of multispectral data can be done
CO3. Student must be able to represent multispectral data

List of Practical:

Sr. No.	Experiment Topics	Practical Hours
01	Perform Practical to install Python and OpenCV.	2
02	Modify the brightness of an image by increasing or decreasing pixel	2
03	Apply a Gaussian Blur to an image to understand image smoothing.	2
04	Perform practical on different Thresholding techniques.	2
05	Perform Practical on Image Transformation (Cropping, Image Translation, Rotating, Scaling).	2
06	Perform a practical on Histogram Equalization.	2
07	Perform practical to calculate gradient magnitude.	2
08	Implement and apply linear filters.	2
09	1. Implement and apply Non-linear Filter. 2. Visualize the frequency domain of an image using the Fourier Transform to understand spatial frequencies. 3. Use Gabor filters to extract texture information from an image.	2
10	Visualize the frequency domain of an image using the Fourier Transform to understand spatial frequencies	2

Syllabus

Semester III

Course code:MCS41MML602	**Course name**: Biometric Techniques	**Course category**: Major Mandatory
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA–60, ESE–40
Prerequisite: Basic knowledge of image processing techniques and programming concepts.		
Course Objectives: Survey the currently available biometric systems. Explore ways to improve current biometric systems		
Course Outcomes: At the end of the course, the students will be able to -		
CO1. Gain a comprehensive understanding of the principles and fundamentals of biometrics, including physiological and behavioral biometric modalities		
CO2. Acquire and apply new knowledge as needed using appropriate learning strategies		
CO3. Understand the importance of biometric standards and regulations, and learn about relevant international standards organizations and regulatory bodies governing biometric		
CO4. Identify and analyze the challenges and limitations associated with biometric technologies, including spoofing attacks, environmental factors, interoperability issues, and societal implications.		
CO5. Design biometric systems for authentication.		

Contents

Units	Topics to be Covered	No. of Lect.
1	**Introduction to Biometric** Introduction: what is biometrics? goals, scope, biometric characteristics, different biometric traits in biometric systems,Biometric Standards,Multi Biometric Systems,Application of of biometric systems Information fusion in Biometrics: Information fusion in Biometrics. Fusion in biometrics. Issue in designing and Multi Biometric System sources and Multiple Evidences Orientation and Frequency Estimation, and Image Quality, Feature Extraction: Ridge **Fingerprint, Face and Iris Recognition:** Friction Ridge Pattern, Fingerprint Acquisition: Sensing Techniques Image Quality, Feature Extraction: Ridge Orientation and Frequency Estimation, Singularity, Ridge and Minutiae Extraction.	**10**
2	**Face Recognition:** Psychology of Face Recognition, Facial Features, Image Psychology of Face Recognition, Facial Features, Image Acquisition, Face Detection, Feature Extraction and Matching **Iris Recognition:** Image Acquisition, Iris Segmentation, Iris Encoding and Matching, Iris Quality	**10**
3	**Additional Biometric Traits:** **Introduction to :** Ear Detection, Challenges of Ear Detection, Gait Recognition, Challenges of Gait recognition Hand Geometry: Image Capture, Hand Segmentation, Feature Extraction, Feature Matching and Challenges of Hand Geometric Recognition. Periocular, Face Marks, Tattoo	**09**
4	**Multi-Biometrics:** Multi-Sensor System, Multi-Algorithm System, Multi- Instance System, Multi-Sample System, , Acquisition and Processing Sequence	**8**

	Fusion Levels: Sensor-Level Fusion, Feature-Level Fusion, Score-Level Fusion, Rank-Level Fusion and Decision-Level Fusion	
5	**Security of Biometric System** Adversary Attacks**: :** Insider Infrastructure attacks, Attacks at the interface: Impersonation, Obfuscation Spoofing attacks on biometric processing: Attacks on the system module, attacks at the interconnection	8

Text Book:

1. Essentials of Bioinformatics, Jin Xiong,CAMBRIDGE UNIVERSITY PRESS
2. Handbook of Multibiometrics , Anil K. Jain, Arun A. Ross, KarthikNandakumar, Springer Science & Business Media

Reference Book:

1. Biometrics: Theory, Methods and Applications, N. V. Boulgouris, Konstantinos, N. Plataniotis, Evangelia, Micheli-Tzanakou, John Wiley & Sons

Syllabus
Semester III

Course Code:MCS41MMP602 **Course name**: Practical Based on Biometric Techniques **Course category**: Major Mandatory
Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20
Pre-requisites: Basics of mathematics
Course Objectives: Acquire knowledge about various biometric technologies such as fingerprint recognition, iris recognition, face recognition, voice recognition, and other emerging modalities
Course Outcomes: At the end of the course, the students will be able to –
CO1. Learn the process of designing and implementing biometric systems, including system architecture, database management, integration with existing systems, and security considerations.
CO2. Gain hands-on experience in biometric data acquisition techniques, including sensor technologies, image processing, feature extraction, and template matching algorithms
CO3. Learn about the practical applications of biometric systems in different domains such as security, access control, identity verification, surveillance, and forensic science.

List of Practicals:

Sr. No.	Experiment Topics	Practical Hours
01	Read the image of the fingerprint and use different techniques of noise reduction	2
02	Preprocess fingerprint images, including tasks such as ridge detection.	2
03	Enhance the image by using Linear Filter	2
04	Perform the segmentation on fingerprint	2
05	Extract key features such as finger length, width, and hand shape from the captured images.	2
06	Evaluate the performance of the system in terms of accuracy, speed, and robustness.	2
07	Investigate vulnerabilities like spoofing attacks and assess the system's resilience.	2
08	Implement algorithms to match captured fingerprints against a database.	2
09	Design Graphical User Interface for Fingerprint Recognition	2
10	Design Graphical User Interface for Iris Recognition	2

Syllabus
Semester III

C**ourse code:**MCS41MML603	**Course name**: Internet of Things	**Course category:** Major Mandatory
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA–60, ESE– 40

Pre-requisites: Basic understanding of Microcontroller and Microprocessors**.**

Course Objectives: To understand the state of art Internet of Things

Course Outcomes: At the end of the course, the students will be able to -

CO1: Describe the fundamentals of Internet of Things

CO2: Understand the state of art design principles and internet principles of IoT

CO3: Extend the understanding of sensors, sensor technology, actuators and RFID in IoT

CO4: Develop a better understanding of data acquisition, storage, cloud computing platforms, privacy, and security and vulnerability solutions in IoT

CO5: Extend the understanding of real time application of IoT

Contents

Unit	Content	Teaching hours
1	**Overview of Internet of Things:** IoT definition and vision, Characteristics of IoT, IoT conceptual framework, IoT architectural view, Technology behind IoT, Sources of IoT, M2M communication, Wearable smart watch, an example of IoT, Smart home, an example of IoT, Smart cities, an application of IoT.	10
2	**Design Principles and Internet Connectivity Principles** Fundamentals of design principles, Communication technologiesn IoT/M2M systems, layers and designs standardization, Data Enrichment, Data Consolidation and Device Management at Gateway, Ease of designing and affordability, Web communication protocol for connected devices, Message communication protocol for connected devices, Web Connectivity for Connected-Devices, Network using Gateway, SOAP, REST, HTTP, RESTful and WebSockets Internet –based communication, IP addressing in IoT	10
3	**Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks:** Sensor technology, Analog sensors, Digital sensors, Participatory Sensing, Industrial IoI, Automotive IoT, Actuators, Sensor data communication protocols, Radio Frequency identification Technology (RFID), Wireless Sensor Network (WSN) concept, WSN architecture.	10
4	**Data Acquisition, Organization, Storage and Computing as Cloud Platforms:** Data acquisition , storage and organization, Cloud computing paradigm for data collection and storage and computing, IoT Cloud-based services and models , **IoT Privacy, Security and Vulnerabilities Solutions:** Defining basic terms associated to privacy & security in IoT, Vulnerabilities, security requirements and threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity management, and establishment, Access control and secure message communication, Security models, Profiles and protocols for IoT,	10
5	Applications:	05

	Connected RFIDs Supply Chain Monitoring Project, Customer monitoring in IoT Applications/Services Project, Connected car and its applications and services: Tesla an example, IoT applications for smart homes, cities, environment monitoring and agriculture., Case study: smart city streetlight control and monitoring,	

Text Book:

1. Software Engineering -A Practitioners Approach , Roger S. Pressman, Mcgraw Hill, International Education, 3rd /4th Edition
2. An Integrated Approach To S/w Engineering, PankajJolote**,**Narosa. 1st / 2nd Edition,

Reference Book:

1. Software Engineering-A Programming Approach, D. Belie I. Moray, J. Rough, PHI
2. Software Testing Techniques, Barrios Bier,Ostrand Reinhold, 2nd Edition, Van N
3. Software Engineering -A Practitioners Approach , Roger S. Pressman, Mcgraw Hill, International Education, rd /4th Edition

Online Resources: 1.NPTEL : Project Management

2. SWAYAM : Software Project Management

Syllabus
Semester III

Course Code: MCS41MMP603**Course name:** Practical Based on Internet of Things **Course category:** Major Mandatory		
Credits: 1	Teaching scheme: L-0 P-1	Evaluation scheme: CA–30 , ESE- 20
Pre-requisites: Basic understanding of Microcontroller and Microprocessors.		
Course Objectives: To understand the state of art Internet of Things		
Course Outcomes: At the end of the course, the students will be able to –		
CO1: Understand the working of Microcontroller chips.		
CO2: Extend the understanding of sensors with their implementation in real.		
CO3: Describe the role of cloud storage, Amazon Web Services and communication APIs		

List of Practicals:

Sr. No.	Title of the Experiment	Practical hours
1	Study of Arduino Uno Microcontrollers and Arduino IDE	2
2	To demonstrate blinking of LED using Arduino Uno	2
3	To demonstrate sensing the available networks using Arduino	2
4	To demonstrate the use of ultrasonic sensor integrating with Arduino board	2
5	To demonstrate the use of ultrasonic sensor integrating with Arduino board	2
6	To demonstrate the use of vibration sensor integrating with Arduino board	2
7	To establish the connection with the available Wi-Fi using Arduino and wifi module	2
8	Demonstrate the touch sensor using Arduino board Demonstrate the use of temperature and humidity sensor integrating with Arduino board	2
9	Demonstrate the working of LDR sensor integrating with Arduino board	2
10	Study on Amazon web Services for IoT Study on Cloud Storage models & Communication APIs	2
11	Project	10

Syllabus
Semester III

Course code: MCS41MEL601	**Course name**: Block Chain	**Course category**: Major Elective
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA–60, ESE– 40
Pre-requisites: Good programming Skill and domain knowledge of Networking & routing.		
1. Be able to explain what is blockchain 2. Be able to explain why we need blockchain. What is the real world problem(s) that blockchain is trying to solve 3. Understand and describe how blockchain works 4. Understand underlying technology of transactions, blocks, proof-of-work, and consensus building		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Describe blockchain technology and its key concepts		
CO2: Explain Bitcoin transaction processes		
CO3: Work with Ethereum deployment tools		
CO4: Deploy a business network using Hyperledger Composer		

Contents:

Unit	Content	Teaching hours
1	**Introduction to Blockchain** Backstory of Blockchain, What is Blockchain?, Centralized vs. Decentralized Systems, Layers of Blockchain, Why is Blockchain Important?, Blockchain Uses and Use Cases, How Blockchain Works?, Laying the Blockchain Foundation, Cryptography, Game Theory, Computer Science Engineering, Properties of Blockchain Solutions, Blockchain Transactions, Distributed Consensus Mechanisms, Blockchain Applications, Scaling Blockchain	10
2	**Bitcoin Mechanics and Optimizations** How Bitcoin Works: The History of Money, Dawn of Bitcoin, The Bitcoin Blockchain, The Bitcoin Network, Bitcoin Scripts, Full Nodes vs. SPVs, Bitcoin Wallets	10
3	**Smart Contracts** How Ethereum Works, Bitcoin to Ethereum, Enter the Ethereum Blockchain, Ethereum Smart Contracts, Ethereum Virtual Machine and Code Execution, Ethereum Ecosystem	10
4	**Scaling Blockchain** Decentralized Applications, Blockchain Application Development, Interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum—Sending Transactions, Interacting Programmatically with Ethereum—Creating a Smart Contract, Interacting Programmatically with Ethereum—Executing Smart, Contract Functions, Blockchain Concepts Revisited, Public vs. Private Blockchains, Decentralized Application Architecture	10
5	**Enterprise Blockchain** Building an EthereumDApp: The DApp, Setting Up a Private Ethereum Network, Creating the Smart Contract, Deploying the Smart Contract, Client Application	5

Text Books: 1. Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions, Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, A press, ISBN-13 (pbk): 978-1-4842-3443-3.

Reference Books: 1. Bitcoin and Crypto currency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder .

Syllabus
Semester III

Course Code: MCS41MEP601 **Course name:** Practical Based on Block chain **Course category**: Major Elective Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20
Pre-requisites: Good programming Skill and domain knowledge of Networking & routing**.**
Course Objectives:
1. How does blockchain exist in the public domain (decentralized, distributed) yet maintain transparency, privacy, anonymity, security, immutability, history
2. Why people value a 'digital' currency, how it can be protected against scam, fraud, hacking and devaluation
Course Outcomes: At the end of the course, the students will be able to -
1: Work with Ethereum deployment tools
2: Deploy a business network using Hyperledger Composer
3: Develop and deploy smart contracts on Ethereum test network

List of Practicals :

Sr. No.	Title of the Experiment	Practical hours
1	Explore various popular blockchain applications. Create a list of those applications and the industries/businesses they are impacting	2
2	Explore the bitcoin blockchain on blockchain.info	2
3	Use an online service to generate hashes for content	2
4	Build a transaction and then hash it. Generate public and private keys. Digitally sign a transaction	2
5	Explore the bitcoin blockchain on blockchain.info for block generation. Explore how long it takes a block to be confirmed.	2
6	Use an online service to illustrate how consensus is built in a distributed system with no central authority.	2
7	What is the computing power needed to mine and generate bitcoin? Explore if miner pools are dominating bitcoin mining. Compare incentives from mining activity vs transaction fees.	2
8	Install a bitcoin wallet. Generate and secure your private key. Send a small transaction amount (to be monetized by instructor) to another user. Track the transaction through blockchain. Verify the confirmation and commitment of the transaction to the bitcoin blockchain.	2
9	Pick three industries. Research the application of blockchain in those industries. Describe how blockchain could be successful in those industries.	2
10	Develop and deploy smart contracts on Ethereum test network	2
11	Deploy a business network using Hyperledger Composer	2
12	Project	10

Syllabus

Semester III

Course code: MCS41MEL602	**Course name:** Data Analytics	**Course category:** Major Elective
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA–60, ESE– 40
Pre-requisites: Knowledge of Database Management System is necessary		
Course Objectives: To equip students with the necessary skills and knowledge to effectively analyze and derive insights from large datasets.		
Course Outcomes: At the end of the course, the students will be able to - **CO1.** Introduce students to the basic concepts, techniques, and tools used in data analytics, including data pre-processing, exploration, analysis, and visualization.		
CO2. Enable students to perform exploratory data analysis techniques to gain insights into the structure, patterns, and relationships within datasets using statistical and visualization methods. **CO3.** Students will be able to create clear and informative data visualizations to effectively communicate findings and insights to diverse audiences. **CO4.**Introduce students to big data technologies and platforms for handling and analyzing large-scale datasets, including distributed computing frameworks like Hadoop and Spark. **CO5.** Students will apply machine learning algorithms to solve real-world problems, including classification, regression, clustering, and recommendation systems.		

Contents:

Unit	Topics to be Covered	Teaching hours
1	Fundamentals of Big Data Understanding Big Data: Concepts and Terminology – Big Data Characteristics – Types of Data – Case Study Background – Drivers for Big Data Adoption: Information and Communication Technology – Big Data Analytics Lifecycle	**08**
2	Fundamentals of Hadoop Core components of Hadoop- Apache Hadoop – HDFS Daemons – MapReduce Daemons – HDFS High Availability Daemons – Benefits and Challenges of HDFS – File Sizes, Block Sizes and Block Abstraction in HDFS – Data Replication – How does HDFS Store, Read, and Write Files? – Data Serialization Options – File System Shell Commands for HDFS	**10**
3	HDFS and MapReduce Choosing Key and Value Types for MapReduce Jobs – The Relationship of Input Keys to Output Keys – Sorting Keys and Values – Sort and Shuffle Process – MapReduce Job Configuration and Submission Hadoop Distributed File System – MapReduce Framework – Setting the Environment – Hadoop Cluster Modes – Running a MapReduce Job with the MR1Framework - Running a MapReduce Job with the Yarn Framework – Running Hadoop Streaming	**09**
4	Apache Hive: Setting the Environment – Configuring Hadoop, Hive – Starting HDFS, Hive Server, CLI – Creating and Using a Database– Creating a Managed Table – Loading data into a Table – Creating a Table using LIKE – Adding Data into a Table from Queries – Adding Data using INSERT INTO TABLE - Adding Data using INSERT OVERWRITE – Creating a table using CREATE TABLE AS SELECT – Altering, Truncating and Dropping a Table– Creating an External Table – Apache HBase: Setting the Environment - Configuring Hadoop, Hive and HBase – Starting the HBase and HBase Shell – Creating HBase Table – Adding Data to a Table – Listing all Tables – Getting a Row of Data – Scanning a Table – Counting the Number of Rows in a Table – Altering a Table – Deleting a Table Row, Column – Disabling and Enabling a Table – Truncating and Dropping a Table – Determining If Table Exists – Creating a Hive External Table stored by HBase	**10**
5	V Pig Introduction – Installing and Running Pig – Grunt – Pig‟s Data Model – Introduction to Pig Latin – Advanced Pig Latin – Developing and Testing Pig Latin Scripts – Making Pig Fly – Writing Evaluation and Filter Functions – Writing and Loading Store Function	**08**

Text Book :

1. Alan Gates, “Programming Pig”, Oreilly Publication, 2011.
2. Deepak Vohra, “Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools”, Apress, 2016.
3. Thomas Erl, WajidKhattak, Paul Buhler, “Big Data Fundamentals Concepts, Drivers & Techniques”, Service Tech Press, 2015

Reference Book:

1. Noreen Burlingame , “The little book on Big Data”, New Street publishers, 2012.
2. Anil Maheshwari, “ Data Analytics”, McGraw Hill Education, 2017.

Online Resources: 1.NPTEL : Introduction to Data Analytics , Introduction to Data Analytics
2. SWAYAM : Data Analytics and Business Intelligence, Big Data Analytics

Syllabus
Semester III

Course Code: MCS41MEP602 **Course name:** Practical Based on Data Analytics **Course Category**:Major Elective Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20
Pre-requisites: Knowledge of Database Management System is necessary
Course Objectives: Introduce students to the basic concepts, techniques, and tools used in data analytics, including data preprocessing, exploration, analysis, and visualization.
Course Outcomes: At the end of the course, the students will be able to –
CO1. Develop critical thinking and problem-solving skills by working on data analytics projects, addressing real-world challenges and making data-driven decisions.
CO2. Understand the importance of collaboration, teamwork, and ethical considerations in data analytics projects, adhering to best practices and ethical guidelines.
CO3. Gain practical experience with popular data analytics tools and programming languages

List of Practical :

Sr. No.	Experiment Topics	Practical hours
01	Research and present on various definitions and characteristics of Big Data.	2
02	Analyze different types of data (structured, semi-structured, unstructured) and their significance in Big Data analytics.	2
03	Create a flowchart or diagram illustrating the various stages of the Big Data analytics lifecycle (e.g., data acquisition, data storage, data processing, data analysis, data visualization).	2
04	Install Apache Hadoop on a local or virtual machine environment. Configure Hadoop settings and examine the Hadoop configuration files.	2
05	Explore the Hadoop Distributed File System (HDFS) by performing tasks such as file creation, deletion, and manipulation using HDFS commands.	2
06	Write a simple MapReduce program to analyze a dataset and calculate basic statistics.	2
07	Experiment with different key-value types and sorting techniques in MapReduce jobs.	2
08	Set up a small Hadoop cluster environment with multiple nodes using virtual machines or cloud services.	2
09	Install and configure Apache HBase on a Hadoop cluster.	2
10	Experiment with table schema alterations and table management operations.	2
11	Project	10

Syllabus
Semester III

Course code: MCS41MEL603 **Course name:** Neural Network with Fuzzy Logic **Course category**: Major Elective **Credits:** 3 **Teaching scheme:** L-3 P-0 **Evaluation scheme:** CA–60, ESE– 40
Pre-requisites: Basic understanding of machine learning concepts. Basic understanding of neural network concepts, including feedforward neural networks, activation functions, and backpropagation.
Course Objectives: To introduce students to the fundamental concepts of biological neurons and neural network models.
Course Outcomes: At the end of the course, the students will be able to -
CO1. Develop the ability to evaluate and compare the performance of different neural network architectures, including single-layer perceptrons, multilayer perceptrons, radial basis function networks, and recurrent neural networks
CO2. Acquire problem-solving skills in optimization, pattern recognition, and associative recall tasks using techniques such as simulated annealing, Boltzmann machines, and Bidirectional Associative Memory (BAM) networks.
CO3. Design and implement fuzzy controllers for various control systems, demonstrating proficiency in fuzzy logic principles and applications.
CO4. Develop critical thinking skills through the analysis of neural network algorithms, learning rules, and their practical applications in real-world scenarios
CO5. Design and implement fuzzy controllers for various control systems, understanding the extension principle and defuzzification methods.

Contents:

Unit	Topics to be Covered	Teaching hours
1	Introduction: Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Knowledge representation. Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules.	07
2	1. Single Layer Perceptron: Perceptron convergence theorem, Method of steepest descent - least mean square algorithms. Multilayer Perceptron: Derivation of the back-propagation algorithm, Learning Factors.	09
3	Radial Basis and Recurrent Neural Networks: RBF network structure, theorem and the reparability of patterns, RBF learning strategies, K-means and LMS algorithms, comparison of RBF and MLP networks, Hopfield networks: energy function, spurious states, error performance .	10
4	Simulated Annealing: The Boltzmann machine, Boltzmann learning rule, Bidirectional Associative Memory.	09
5	Fuzzy logic: Fuzzy sets, Properties, Operations on fuzzy sets, Fuzzy relations, Operations on fuzzy relations, The extension principle, Fuzzy measures, Membership functions, Fuzzification and defuzzification methods, Fuzzy controllers	10

Text Book: 1. Simon Haykin, ìNeural Network a - Comprehensive Foundationî, Pearson Education **2.** 2. Zurada J.M., ìIntroduction to Artificial Neural Systems, Jaico publishers
Reference Book: 3. Thimothy J. Ross, ìFuzzy Logic with Engineering Applicationsî, McGraw Hill **4.** 4. Ahmad Ibrahim, ìIntroduction to Applied Fuzzy Electronicsî, PH
Online Resources: 1.NPTEL: Introduction to Machine Learning, Artificial Intelligence 2. SWAYAM : Introduction to Artificial Intelligence and Machine Learning

Syllabus
Semester III

Course Code: MCS41MEP603	**Course name:** Practical Based on Neural Network with Fuzzy Logic	
Course category: Major Elective		
Credits: 1	Teaching scheme: L-0 P-1	Evaluation scheme: CA–30, ESE– 20
Pre-requisites: Basic understanding of machine learning concepts. Basic understanding of neural network concepts, including feedforward neural networks, activation functions, and back propagation.		
Course Objectives: To provide hands-on experience with fuzzy logic applications in decision-making and control systems.		
Course Outcomes: At the end of the course, the students will be able to –		
CO1. Develop critical thinking skills through the analysis of neural network algorithms, learning rules, and their practical applications in real-world scenarios.		
CO2. Design and implement fuzzy controllers for various control systems, demonstrating proficiency in fuzzy logic principles and applications.		
CO3. Gain hands-on experience through practical exercises and projects involving the implementation and experimentation of neural network models, fuzzy logic systems, and related algorithms.		

List of Practicals :

Sr. No.	Experiment Topics	Practical hours
01	Develop a simple simulation of biological neurons based on the McCulloch and Pitts model.	2
02	Explore different types of activation functions (e.g., step function, sigmoid function) and observe their effects on neuron behavior.	2
03	Implement basic knowledge representation systems using neural networks.	2
04	Create neural network models to represent and store structured information	2
05	Implement the perceptron algorithm and verify the convergence theorem on linearly separable datasets.	2
06	Implement the perceptron algorithm and verify the convergence theorem on linearly separable datasets.	2
07	Implement the back propagation algorithm for training multilayer perceptrons.	2
08	Implement RBF networks for pattern recognition tasks.	2
09	Implement operations on fuzzy sets, such as union, intersection, and complement.	2
10	Implement operations on fuzzy relations, such as composition and max-min composition.	2
11	Project	10

Syllabus

Semester III

Course code: MCS41MEL604	**Course name:** Native React	**Course category:** Major Elective
Credits: 3	**Teaching scheme:** L-3 P-0	**Evaluation scheme:** CA–60, ESE– 40
Pre-requisites: Proficiency in JavaScript, as React Native primarily uses JavaScript for app development.		
Course Objectives: Familiarity with React.js concepts such as components, props, state, and JSX.		
Course Outcome: **CO1.** Students will gain proficiency in developing mobile apps using React Native, understanding its architecture, and leveraging its features for cross-platform development.		
CO2. Students will be able to set up development environments for React Native on Android and iOS platforms and develop mobile apps from scratch.		
CO3. Students will develop skills in debugging React Native apps and handling common issues encountered during app development.		
CO4. Students will understand the principles of Redux and its integration with React Native for efficient state management in mobile apps.		
CO5. Students will be equipped to deploy React Native apps to app stores and perform maintenance tasks, including handling API requests, error handling, and authentication.		

Contents

Unit	Topics to be Covered	Teaching Hours
1	Introduction to mobile app development, Types of mobile apps (native, hybrid, web), Key considerations in mobile app development (performance, user experience, platform differences), Cross-platform app development and popular frameworks, What is React Native and how does it work?, Features, advantages and limitations of React Native, React Native for mobile app development - market trend and scope	**08**
2	Introduction to Simulators and Emulators, How to setup react native for android and iOS, File structure of a React Native App. Introduction to components and its types, Core components of react native, Understanding Props and State in React Native, Class components, Functional Components, Introduction to Hooks, Styling methods and flexbox in React native, API's of react native	**10**
3	Introduction to libraries of react native (document), React-navigation between screens, Alternatives for navigations in react native, Introduction to platform-specific coding, How to write platform specific code in react native,	**08**
4	How to debug a React Native app Introduction to Redux and required prerequisites, Setup Redux Environment, Core concepts of Redux, Data flow in Redux Architecture	09
5	Store, Actions, State Reducers, Provider, Redux Data Flow, Understanding the key principles of Redux. API Requests, Error Handling, The HookLogic, UseEffect, Grouping, Styling and Related Issues, JSON Server Setup, NOSQL Setup, Authentication	**10**

Text Book:

1. "React Native: Building Mobile Apps with JavaScript" by Bonnie Eisenman
2. "Learning React Native: Building Native Mobile Apps with JavaScript" by Bonnie Eisenman

Reference Book:

1. "Pro React Native: Build Native Mobile Apps for iOS and Android" by Alex Banks and Ari Lerner
2. "React Native for iOS Development" by Akshat Paul, Abhishek Nalwaya, and Shubhang Tripathi

Online Resources: 1.NPTEL: Mobile Computing and Applications, Introduction to React Native
2. SWAYAM: Mobile Application Development, Modern Application Development

Syllabus
Semester III

Course Code: MCS41MEP604 **Course name:** Practical Based on Native React **Course category**: Major Elective Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20

Pre requisites: Familiarity with HTML and CSS for understanding mobile app layout and styling

Course Objectives: Provide insights into key considerations in mobile app development, such as performance, user experience, and platform differences. Explore the scope and trends in cross platform app development, with a focus on React Native.

Course Outcomes: At the end of the course, the students will be able to –
CO1. Set up development environments for React Native on Android and iOS platforms and develop mobile apps from scratch
CO2. Develop skills in debugging React Native apps and handling common issues encountered during app development.
CO3. Students will understand the principles of Redux and its integration with React Native for efficient state management in mobile apps.

List of Practicals :

SR. No.	Experiment Topics	Practical hours
01	Install necessary software such as Node.js, npm, and React Native CLI.	2
	Set up Android Studio and Xcode for Android and iOS development environments.	2
02	Create a basic React Native project using the command-line interface. Display a simple UI component (e.g., text, button) on the screen.	2
03	Create platform-specific components to handle differences in UI/UX for Android and iOS platforms.	2
04	Test the app on both Android and iOS emulators/simulators to observe platform-specific behaviors.	2
05	Create and render various core components provided by React Native, such as View, Text, Image, and TextInput.	2
06	Experiment with styling these components using inline styles and stylesheet objects.	2
07	Create functional and class components that utilize props and state to manage data and UI updates.	2
08	Set up navigation between screens using React Navigation library.	2
09	Create a simple app with multiple screens and implement navigation between them.	2
10	Modify UI components and behavior to adapt to platform-specific guidelines and conventions.	2
11	Project	

Semester: FOURTH

Syllabus

Semester IV

Course code: MCS41MML604	**Course name:** Machine Learning	**Course category:** Major Mandatory
Credits: 3	**Teaching scheme:** L-3 P-0	**Evaluation scheme:** CA–60, ESE– 40

Pre-requisites: Basic understanding of linear algebra, including matrices, vectors, and operations. Fundamental knowledge of calculus, particularly differentiation and integration. Proficiency in at least one programming language, preferably Python

Course Objectives: Understand the fundamental concepts and principles of machine learning

Course Outcomes: At the end of the course, the students will be able to -

CO1. Implement and evaluate supervised learning algorithms such as linear regression, logistic regression, decision trees, support vector machines, and neural networks.

CO2. Master in unsupervised learning techniques such as clustering and dimensionality reduction

CO3. Preprocess and clean datasets using techniques like feature scaling, feature engineering, and handling missing values.

CO4. Understand advanced topics in machine learning such as ensemble methods, deep learning, and natural language processing.

CO5. Critically analyze and interpret machine learning models' results and make informed decisions based on them

Contents

Unit	Content	Teaching hours
1	**Introduction To Machine Learning:** Introduction to Analytics and Machine Learning,What is Machine Learning, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning, Why Machine Learning?, Framework for Developing Machine Learning Models, State-of-the-Art Languages/Tools In Machine Learning. **Descriptive Analytics:** Working with DataFrames in Python, Handling Missing Values, Exploration of Data using Visualization: Drawing Plots, Bar Chart, Histogram, Distribution or Density Plot, Box Plot, Comparing Distributions, Scatter Plot, Pair Plot, Correlation and Heatmap.	**10**
2	**Linear Regression:** Simple Linear Regression, Steps in Building a Regression Model, Building Simple Linear Regression Model, Model Diagnostics, Multiple Linear Regression.	**10**
3	**Classification:** Classification Overview, Binary Logistic Regression, Credit Classification, Gain Chart and Lift Chart, Classification Tree (Decision Tree Learning)	**10**
4	**Clustering:** Overview, How Does Clustering Work?,K-Means Clustering, Creating Product Segments Using Clustering, Hierarchical Clustering.	**10**
5	**Advances In Machine Learning:** Gradient Descent Algorithm, Scikit-Learn Library for Machine Learning, K-Nearest Neighbors (KNN) Algorithm, Random Forest.	**05**

Text Books: 1.Applied Machine Learning, M. Gopal, McGraw-Hill Education.

Reference Books: 1.Machine Learning for Text, Charu C. Aggarwal, Springer.

Syllabus

Semester IV

Course Code: MCS41MMP604 **Course name**: Practical Based on Machine Learning **Course Category**: MajorMandatory Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20
Pre requisites: Knowledge of fundamental concepts in computer science, such as loops, conditionals, and functions

.

Course Objectives: Explore various machine learning techniques such as supervised learning, unsupervised learning, and reinforcement learning.

Course Outcomes: At the end of the course, the students will be able to –
CO1. Understand the ethical implications and considerations in machine learning applications.
CO2. Develop critical thinking skills to select appropriate algorithms and techniques for different problems.
CO3. Awareness of ethical considerations in collecting, processing, and using data for machine learning applications, and ability to design fair and unbiased models

List of Practicals :

Sr. No.	Experiment Topics	Practical hours
01	Explore various analytics and machine learning use cases across different industries.	2
02	Working with DataFrames in Python using libraries such as Pandas.	2
03	Exploring data using visualization techniques: creating various plots such as bar charts, histograms, scatter plots, etc., using libraries like Matplotlib and Seaborn.	2
04	Implement simple linear regression from scratch or using libraries like scikit-learn	2
05	Extend to multiple linear regression and compare the results.	2
07	Implement binary logistic regression for a classification task.	2
08	Implement K-Means clustering algorithm from scratch or using libraries like scikit-learn.	2
09	Use clustering to create product segments or customer segments from a given dataset.	2
10	Implement the K-Nearest Neighbors (KNN) algorithm for classification or regression tasks.	2
11	Project	10

Text Books: 1.Applied Machine Learning, M. Gopal, McGraw-Hill Education.
Reference Books: 1.Machine Learning for Text, Charu C. Aggarwal, Springer.

Syllabus
Semester IV

Course code: MCS41MEL605 **Course name**: Natural Language Processing **Course category**: Major Mandatory **Credits:** 3 **Teaching scheme:** L-3 P-0 **Evaluation scheme:** CA–60, ESE– 40
Pre-requisites: Basic understanding of programming concepts, preferably in Python
Course Objectives: Understand the fundamental concepts and theories underlying natural language processing. Gain proficiency in processing and analyzing text data using NLP techniques.
Course Outcome: At the end of the course, the students will be able to -
CO1. Preprocess and clean text data for NLP tasks, including tokenization, stemming, and lemmatization
CO2.Understand Strengths and weaknesses of various NLP technologies and frameworks
CO3. Proficiency in performing basic NLP tasks such as part-of-speech tagging, named entity recognition, and sentiment analysis.
CO4. Build and evaluate text classification models using techniques like bag-of-words, TF-IDF, and machine learning algorithms such as Naive Bayes and Support Vector Machines.
CO5. Knowledge of advanced NLP techniques such as word embeddings, sequence-to-sequence models and transformers

Contents

Unit	Topics to be Covered	Teaching Lectures
1	Introduction to NLP_, History, text analytics and NLP, various steps in NLP, types of data, structured, unstructured data, cleaning ,stop word removal ,text data, feature extraction from texts, feature engineering. Basic feature extraction methods.	**09**
2	Machine learning algorithm for text data, text classification techniques, text classifiers, pipeline methods for NLP models, techniques of text data collection from web-collecting data by scraping web page, requesting content from web page, dealing with semi structured data, topic modeling using LSA and LDA	**09**
3	Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, POS tagging, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance Extract and process data from web pages,Describe different kinds of semi-structured data, such as JSON and XML, Extract real-time data using Application Programming Interfaces, Extract data from various file formats	**09**
4	Context Free Grammar Top-Down and Bottom-up parsing, Text Summarization and Text Generation Describe the Text Rank algorithm, Implement text summarization using Gensim , Implement text summarization using word frequency, Generate text using Markov chains ,Vector Representation Describe the need for vector representation in Natural Language Processing (NLP),Identify the various ways that text can be represented as vectors ,Describe word vectors and their various forms, Implement vector arithmetic, Describe document vectors	**09**
5	Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Back off, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. Module 6: Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis-Describe sentiment analysis and its applications,Describe various tools in sentiment analysis, Perform sentiment analysis using the Text Blob library, Demonstrate how to load data for sentiment analysis, Demonstrate the training of a sentiment analysis model Opinion Mining and Emotion Analysis, Resources and Techniques	**09**

Text Books: Introduction to Automata Theory Language and Computation, Hopcroft H.E. and Ullman J. D., Pearson. 2. Theory of Computer Science, Automata Languages and computation, Mishra and Chandrashekaran PHI
Reference Books: 3. C.K.Nagpal, Formal Languages and Automata Theory, Oxford 1. LarryWall, Manning and Schutze, Foundation of Statistical Natural Language Processing, MIT Press
Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus
Semester IV

Course Code: MCS41MEP605	**Course name:** Practical Based on Natural Language Processing	
Course category: Major Mandatory		
Credits: 1	Teaching scheme: L-0 P-1	Evaluation scheme: CA–30, ESE– 20
Pre requisites: Fundamental knowledge of probability, statistics, and linear algebra		

Course Objectives: Proficiency in working with text data and manipulating strings.

Course Outcomes: At the end of the course, the students will be able to –
CO1. Implement NLP applications such as information retrieval, question answering, and machine translation.
CO2. Apply NLP techniques to solve real-world problems in various domains such as healthcare, finance, customer service, and social media analysis.
CO3. Stay updated with the latest advancements in NLP research and adapt to new techniques and technologies in the field.

List of Practicals :

Sr. No.	Experiment Topics	Practical hours
01	Python program to read paragraph	2
02	Python program for word tokenization	2
03	Python program for sentence tokenization	2
04	Python program for stop word removal	2
05	Python program for stemming	2
06	Python program for lemmatization	2
07	Python program for bag of words(BOW)	2
09	Python program for named entity recognition(NER)	2
10	Python program for implementation of Text Summarizer usingNLTK	2
11	Project	10

Syllabus

Semester IV

Course code: MCS41MML606	**Course name:** Remote Sensing and GIS	**Course category:** Major Mandatory
Credits: 2	**Teaching scheme:** L-2 P-0	**Evaluation scheme:** CA–60, ESE– 40

Pre-requisites: Basic understanding of geography and spatial data concepts. Basic knowledge of data analysis and interpretation.

Course Objectives: Understand the fundamental principles of remote sensing, including electromagnetic radiation, sensors, and platforms. Gain proficiency in acquiring, processing, and interpreting remote sensing data

Course Outcome: At the end of the course, the students will be able to -

CO1. Ability to acquire, preprocess, and analyze remote sensing data from various platforms such as satellites, drones, and aerial platforms.

CO2. Proficiency in utilizing GIS software for spatial data management, analysis, and visualization.

CO3. Skills to perform basic and advanced spatial analyses, including overlay operations, proximity analysis, and spatial interpolation.

CO4. Knowledge of different classification techniques for land cover mapping and change detection using remote sensing data.

CO5. Experience in integrating remote sensing and GIS data for spatial modeling and decision support

Contents

Unit	Topics to be Covered	Teaching Hours
1	**Basics of remote sensing:** Electromagnetic Radiation (EMR), Electromagnetic spectrum (EMS), Platforms and sensors, Stages in remote sensing data acquisition, Types of satellites &images, Framing and scanning systems, EMR interaction with atmosphere and earth's surface.Black body radiation and radiation laws.] **Sensors:** Characteristics on board IRS, LANDSAT, SPOT, NOAA, IKONOS, Quickbird satellites, ASTER and SRTM missions, Spectral reflectance of soil, water vegetation and rock types. Spectral, spatial, temporal and radiometric resolutions.	**09**
2	Elements of image interpretation: photographic and geotechnical. Image characteristics of common land cover types, Image characteristics of common rock types- sandstone, shale, limestone, granite, basalt, Characteristics of cultural and natural features, GCPs and their utility. Mapping from remotely sensed data: Image characteristics of Flood inundation, cyclone affected areas, environmentally degraded areas, degraded land and desertified areas,	**09**
3	**Maps:** Elements, scale, base and reference map. Thematic maps. **Toposheets:** cultural and natural features. Types of Map projections: Conical Cylindrical and Azimuthal, Datum and coordinate systems. **Basics of GIS:** Data, structure, relational, hierarchical network input, format, analysis in GIS, Data integration and overlay analysis in GIS, Functions of GIS, Digitization, editing and topology building in GIS	**09**
4	**Introduction to Global positioning system:** GPS satellite constellations, GPS segments: space, control, user, signals & codes. GPS receivers, Operating principle and sources of errors in GPS, Modes of measurements and Post processing of data, accuracy of GPS observation. GPS applications in various fields, Concept of DGPS and WAAS.	**09**

Text Book:

1. Fundamentals of GIS by Micheal Demers
2. Remote Sensing and Geographic Information System by Anji Reddy
3. Remote Sensing and Geographic Information System by A.M. Chandra.

Reference Book:

1. Remote Sensing-Principles and Interpretation by Sabins.
2. Remote Sensing and image interpretation by Lillesand and Keifer
3. Fundamentals of Remote Sensing by George Joseph 7. Remote sensing and GIS by BasudebBhatta

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus
Semester IV

Course code: MCS41MEL605	**Course name:** AWS DevOps	**Course category:** Major Elective
Credits: 3	**Teaching scheme:** L-3 P-0	**Evaluation scheme:** CA–60, ESE– 40
.		
Pre-requisites: Understanding of basic principles of quantum mechanics. Knowledge of linear algebra and complex numbers		
Course Objectives: Gain a comprehensive understanding of fundamental concepts in quantum computation and information. Learn the principles of quantum circuits, algorithms, and quantum gates.		
Course Outcome: At the end of the course, the students will be able to -		
CO1. Understand basic concepts of quantum computing		
CO2. Ability to design and analyse quantum circuits for various quantum algorithms.		
CO3. Understanding of quantum Fourier transform, phase estimation, and their applications.		
CO4. Ability to analyse quantum noise and its impact on quantum operations.		
CO5. Create ability to improve research and development, supply chain optimization and production		

Contents

Unit	Content	Teaching hours
1	**What Is DevOps:** Understanding the Business Need for DevOps, Recognizing the Business Value of DevOps, Enhanced customer experience, Increased capacity to innovate, Faster time to value, How DevOps Works, Develop and test against production-like systems, Deploy with repeatable, reliable processes, Monitor and validate operational quality, Amplify feedback loops	10
2	**Looking at DevOps Capabilities:** Paths to DevOps Adoption, Steer, Develop/Test, Collaborative development, Continuous testing, Deploy, Operate, Continuous monitoring, Continuous customer feedback and optimization	10
3	**Adopting DevOps:** Where to Begin, Identifying business objectives, Identifying bottlenecks in the delivery pipeline, People in DevOps, DevOps culture, DevOps team, Process in DevOps, DevOps as a business process, Change management process, DevOps techniques, Technology in DevOps, Infrastructure as code, Delivery pipeline, Deployment automation and release management	10
4	**How Cloud Accelerates DevOps:** Using Cloud as an Enabler for DevOps, Full-Stack Deployments, Choosing a Cloud Service Model for DevOps, Understanding What a Hybrid Cloud.	10
5	**DevOps to Solve New Challenges:** Mobile Applications, ALM Processes, Scaling Agile, Multiple-Tier Applications, DevOps in the Enterprise, Supply Chains, The Internet of Things	5

Text Books: 1.Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback – Import, 3 Oct 2014 3. Computing since Democritus by Scott Aaronson 4.
Reference Books: 1.Computer Science: An Introduction by N. DavidMermin
2. David McMahon, ―Quantum Computing Explained‖, Wiley ,2008...
Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus

Semester IV

List of Practical –

Course code:MCS41MEP605 **Course name: Practical based on** AWS DevOps **Course category:** Major Elective Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20
Pre-requisites: Basics of Cloud Computing
Course Objectives: learn how these tools are used in software development operations
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand the Fundamentals of DevOps
CO2: Lean DevOps Capabilities
CO3: Adopt DevOps resources and infrastructures
CO4: How DevOps Works with real time Application
CO5: Develop Multiple-Tier Applications

Sr. No.	**Title of the Experiment**	**Practical Hours**
1	Install and Configure DevOps platforms(GitLab, GitHub, Bitbucket)	2
2	Exploring Git Commands through Collaborative Coding.	2
3	Implement GitHub Operations	2
4	Implement BitBucket Operations	2
5	Demonstrate Maven Build Life Cycle	2
6	Applying CI/CD Pipelines to Web Development Using Jenkins, Git, and Local HTTP Server.	2
7	Create the GitHub Account to demonstrate CI/CD pipeline using Cloud Platform.	2
8	Applying CI/CD Pipelines to Web Development Using Jenkins, Git, using Docker Containers	2
9	Exploring Containerization and Application Deployment with Docker	2
10	Demonstrate Container Orchestration using Kubernetes.	2
11	Project	10

Syllabus
Semester IV

Course Code: MCS41MEL606	**Course name:** Quantum Computing	**Course category**: Major Elective
Credits: 3	**Teaching scheme:** L-3 P-0	**Evaluation scheme:** CA–60, ESE– 40
Pre-requisites: Basic knowledge of Mathematics, Data Structures and Algorithm**.**		
Course Objectives:		
1. To understand basics of quantum computing		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand basic concepts of quantum computing		
CO2: Learn Various Quantum Algorithms.		
CO3: Illustrate building blocks of quantum computing through architecture and programming models		
CO4: Quantum Applications and Future Trends.		

Contents

Unit	Content	Teaching Hours
I	**Introduction to Quantum Mechanics** **Overview of Classical vs. Quantum Computing** • Understanding classical bits vs. quantum bits (qubits) • Brief history and motivation for quantum computing **Quantum Mechanics Basics** • Principles of superposition and entanglement • Quantum gates and circuits • Dirac notation and quantum state vectors **Quantum Measurement and Probability** • Measurement in quantum systems • Quantum probability and interference • Bloch sphere representation	6
II	**Quantum Algorithms** **Quantum Parallelism and Superposition** • Quantum parallelism and its implications • Building quantum parallel algorithms **Quantum Fourier Transform and Shor's Algorithm** • Introduction to Quantum Fourier Transform • Shor's Algorithm for integer factorization • Implications for cryptography	8
III	**Quantum Programming** **Quantum Programming Languages** • Overview of Qiskit and Cirq • Basic quantum programming constructs • Writing simple quantum algorithms **Quantum Error Correction** • Basics of quantum error correction • Introduction to quantum error correction codes (e.g., Shor code, Steane code)	8
IV	**Quantum Applications and Future Trends** **Quantum Machine Learning** • Quantum algorithms for machine learning	8

	• Quantum-enhanced classical machine learning **Quantum Cryptography** • Quantum key distribution • Post-quantum cryptography **Emerging Trends and Future Directions** • Quantum computing in industry • Potential impact on various sectors • Ethical considerations and societal implications	

Text Books: 1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2."Quantum Computing: A Gentle Introduction" by Eleanor G. Rieffel and Wolfgang H. Polak

Reference Books: 1. "Quantum Computing for Computer Scientists" by Noson S. Yanofsky and Mirco A. Mannucci
2. David McMahon, ―Quantum Computing Explained‖, Wiley ,2008..

Syllabus
Semester IV

Course Code: MCS41MEP606 **Course name:** Practical Based on Quantum Computing **Course category**: Major Elective Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20
Pre-requisites: Familiarity with classical computation and algorithms.
Course Objectives: Learn about quantum information theory, quantum noise, and quantum operations.
Course Outcomes: At the end of the course, the students will be able to –
CO1. Ability to analyze quantum noise and its impact on quantum operations.
CO2. Capability to construct and analyze quantum codes for error correction.
CO3. Knowledge of entropy and information measures in the context of quantum information theory.

List of Practicals :

Sr. No.	Experiment Topics	Practical Hours
01	Implementing simple quantum circuits for quantum algorithms such as Deutsch's algorithm or Grover's algorithm.	2
02	Simulating single-qubit and multi-qubit operations using quantum programming frameworks like Qiskit or Cirq.	2
03	Implementing quantum Fourier transform and phase estimation algorithms.	2
04	Simulating quantum search algorithms and comparing their performance with classical search algorithms.	2
05	Exploring physical implementations of quantum computers through simulations or experimental setups.	2
06	Analyzing quantum noise and its impact on quantum operations using noise models.	2
07	Constructing and analyzing quantum error correction codes such as Shor codes or stabilizer codes.	2
08	Simulating fault-tolerant quantum computation using error-corrected quantum circuits.	2
09	Exploring entropy and information measures in quantum information theory through calculations and simulations.	2
10	Implementing basic quantum algorithms and protocols on actual quantum hardware if available, and analyzing the results.	2
11	Project	10

Syllabus

Semester IV

Course code: MCS41MEL607 **Course name:** Software Testing and Verification **Course category:** Major Elective
Credits: 3 **Teaching scheme:** L-3 P-0 **Evaluation scheme:** CA–60, ESE– 40

Pre-requisites: Basic understanding of software development processes and methodologies. Familiarity with programming languages and software engineering concepts

Course Objectives: The primary objective of software testing and verification is to ensure that the software meets the specified quality standards and requirements. This involves identifying defects, errors, and discrepancies in the software and verifying that it functions correctly and reliably. Understanding of software quality assurance principles and techniques.

Course Outcomes: At the end of the course, the students will be able to -

CO1. Ensure the reliability and stability of the software under various conditions and scenarios. It involves testing the software in different environments, configurations, and usage scenarios to ensure that it performs consistently and reliably.

CO2. Verify the correctness of the software by comparing its actual behaviour with the expected behaviour. It aims to detect deviations or discrepancies between the expected and actual outcomes and ensures that the software behaves as intended.

CO3. Eensure that the software complies with relevant standards, regulations, and industry best practices. This includes testing for compliance with security standards, accessibility requirements, and legal regulations to ensure that the software is safe, secure, and legally compliant.

CO4. Detect defects early in the development process, testing helps in reducing the cost of fixing errors and defects later in the lifecycle. The objective is to optimize the testing process to achieve the highest level of quality at the lowest possible cost.

CO5. Ensures that the software complies with relevant standards, regulations, and industry best practices. This includes testing for compliance with security standards, accessibility requirements, and legal regulations to ensure that the software is safe, secure, and legally compliant

Contents

Unit	Content	Teaching hours
1	S/w Engineering Fundamentals: Definition of Software, The birth of s/w engineering, s/w Product:, Software development paradigms, software Characteristics and Application. Software Development life cycle, water fall model, Prototyping, Incremental & Spiral model, 4 th Generation Techniques. Project Management: Concepts, Software Process and Project Metrics; Software Measurements; Software Projects Planning: Objectives, Scope and Resources. Software Project Estimating, Decomposition Techniques. Empirical Estimation Models: COCOMO Model, Software Equation. Project Scheduling and Tracking.	10
2	The Software Product and Software Process Software Product and Process Characteristics, Software Process Models: LinearSequential Model, Prototyping Model, RAD Model, Evolutionary Process Models likeIncremental Model, Spiral Model, Component Assembly Model, RUP and Agileprocesses. Software Process customization and improvement, CMM, Product andProcess Metrics System Design: Design concept and principles and its elements, effective modular design, Cohesion & Coupling, Feature of modern graphics interface (GUI). Design Methods: data design, interface design guidelines, procedural design.	10
3	Software Quality Assurance: Definition of Quality and factors, QA, SQA, Software Quality Metrics, Process and Product Quality, The SEI Process Capability Maturity Model (CMM), ISO ,Six-Sigma. Software Quality Assurance, Need for SQA, SQA Activities, Building blocks of	10

	SQA, SQA Planning & Standards, Software Reliability, Reliability Measures. Software Analysis and Testing Software Static and Dynamic analysis, Code inspections, Software Testing, Fundamentals, Software Test Process, Testing Levels, Test Criteria, Test Case Design, TestOracles, Test Techniques, Black-Box Testing, White-Box Unit Testing and Unit, Testing Frameworks, Integration Testing, System Testing and other Specialized, Testing, Test Plan, Test Metrics, Testing Tools. , Introduction to Object-oriented analysis, design and comparison with structured Software Engg.	
4	Levels of Testing Unit Testing, Integration Testing, System Testing, Acceptance Testing, Alpha testing & Beta testing, Static vs. Dynamic testing, Manual vs. Automatic testing, Testers workbench, 11 steps of testing process (Only steps should be covered) Different types of Testing: Installation Testing, Usability testing, Regression testing, Performance testing, Load testing, stress testing, Security testing, Static & Dynamic testing, Static testing techniques, Review types : Informal Review, Technical or peer review, Walkthrough, Inspection, static analysis, Review meeting and reporting , Review guidelines & Review checklist, Data flow analysis,Control flow analysis, Cyclometric Analysis	10
5	Black Box & White Box Testing (Test Case Design Techniques): Functional Testing (Black Box), Equivalence partitioning, BVA, Decision table based testing, Cause-Effect graphing, Syntax testing (Concept & Test case generation only), Structural Testing (White Box), Coverage testing, Statement coverage, Branch & decision coverage, Path coverage, Validation testing Activities, Low level testing, High level testing, Black box Vs. White Box Object Oriented Testing: Issues in OO testing, class testing, GUI testing, Object Oriented Integration & system testing. Computer Aided Software testing tools (CAST): Static Testing Tools, Dynamic Testing Tools, Characteristics of Modern Tools. e.g. WinRunner, LoadRunne.	5

Text Books: 1. Software Engineering – A Practitioners Approach Roger S. Pressman, 3rd /4th Edition, Mcgraw Hill, International Education. 2. An Integrated Approach To S/w Engineering, PankajJolote, 1 st / 2 nd Edition, Narosa. 3. Software Engineering – A Programming Approach, D. Belie I. Moray, J. Rough, PHI.
Reference Books: 1 Software Testing Techniques, Barrios Bier, 2 nd Edition, Van N Ostrand Reinhold. 2. Software Engineering Concepts-Richard Fairley, CDAC. Tata McGraw-Hill Series. 6. ISO-9000 Standards (Relevant ToSoftware).
Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus
Semester IV

Course Code: MCS41MEP607 **Course name:** Practical Based on Software Testing and Verification **Course category**: Major Elective Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20
Pre-requisites: Basic knowledge of data structures and algorithms
.**Course Objectives:** The goal of software testing is to enhance user satisfaction by delivering high-quality software that meets user expectations and provides a positive user experience. Testing helps in building confidence in the software's reliability, functionality, and performance.
Course Outcomes: At the end of the course, the students will be able to –
CO1. Through rigorous testing and verification processes, software defects are identified and addressed, leading to higher quality software products.
CO2. Testing ensures that the software performs consistently and reliably under different conditions, leading to increased confidence in its stability and dependability.
CO3. Software testing verifies that the software meets the specified requirements and performs as intended, ensuring alignment with user expectations

.

List of Practicals:

Experiment No.	Experiment Topics	Practical Hours
01	Write and execute unit tests for individual software components to verify their correctness and functionality.	2
02	Design and execute integration tests to verify the interaction and compatibility of integrated software modules.	2
03	Conduct system tests to validate the overall functionality and performance of the software system.	2
04	Collaborate with stakeholders to perform acceptance tests and ensure that the software meets user requirements and expectations.	2
05	Develop and execute regression tests to ensure that new changes or updates do not introduce unintended side effects or regressions.	2
06	Learn and apply various test case design techniques such as equivalence partitioning, boundary value analysis, and decision table testing.	2
07	Explore test automation tools and frameworks such as Selenium or JUnit to automate repetitive testing tasks and improve efficiency.	2
08	Practice identifying, documenting, and tracking defects using defect tracking tools such as Jira or Bugzilla.	2
09	Conduct performance tests to evaluate the software's responsiveness, scalability, and reliability under different load conditions.	2
10	Perform security tests to identify vulnerabilities and ensure that the software is protected against potential security threats and attack	2
11	Project	10

Syllabus
Semester IV

Co**urse code:** MCS41MEL608 **Course name:** Digital Forensics **Course category:** Major Elective **Credits:** 3 **Teaching scheme:** L-3 P-0 **Evaluation scheme:** CA–60, ESE– 40
Pre-requisites: Understanding of computer systems and networks. Understanding of basic computer security principles and concepts.
Course Objectives: Gain a comprehensive understanding of digital forensics principles, techniques, and methodologies. Learn to conduct forensic investigations to gather, preserve, and analyze digital evidence from various sources such as computers, mobile devices, and networks.
Course Outcomes: At the end of the course, the students will be able to - CO1. Effectively plan and execute digital forensic investigations, including evidence identification, collection, preservation, and analysis. CO2. Aware the emerging trends and challenges in digital forensics and the ability to adapt and innovate in response to evolving threats and technologies.

Contents

Unit	Content	Teaching hours
1	**Cyber Security Fundamentals:** Overview of cyber security, Definition and types of cyber threats, Usecases: Morris worm, DDos Attack Definition and Types of Malwares: Malware Basics, Worms, Virus, Rootkits, Trojan Horses: Trojans, Ransomware, Spyware, Malware analysis tools, Advanced persistent threat	05
2	**E-mail Analysis:** Finding E-mail Artifcats, converting e-mail formats, Client-based e- mail, web-based e-mail, internet hosted mail, investigating e-mail headers	10
3	**Tracking User Activity:** Tracking Web usage, Internet explorer forensics, firefox/mozilla forensics, operating system user logs **Memory Forensics**: Memory acquisition, Memory analysis, memory analysis tools	10
4	Incident Response: Introduction to incident response, preparing for incident response, mac time analysis	10
5	**Forensic Analysis of Mobile Devices:** Collecting and analyzing mobile device, password- protected windows devices **Recent Advances in Digital Forensics:** Discussing latest papers in the field	10

Text Books: 1. Davis, Philipp, and Cowen, Hacking Exposed: Computer Forensics, McGraw Hill Education 2. K. Mandia, M Pepe, J. Luttgens, Incident Response & Computer Forensics, Third Edition
Reference Books: 1. M.H. Ligh, A. Case, J. Levy, A. waters, The art of memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory, Wile 2. A book from honeynet project. Know your enemy: Learning about security threats, Addison Wesley
Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus
Semester IV

Course Code: MCS41MEP608 **Course name:** Practical Based on Digital Forensics **Course category**: Major Elective Credits: 1 Teaching scheme: L-0 P-1 Evaluation scheme: CA–30, ESE– 20
Pre-requisites: Ability to use various software and tools for data analysis and investigation.
Course Objectives: Understand the role of digital forensics in supporting law enforcement, legal proceedings, incident response, and cyber security investigations
Course Outcomes: At the end of the course, the students will be able to –
CO1. Prepare comprehensive forensic reports and documentation to present findings and conclusions to stakeholders.
CO2. Collaborate with law enforcement agencies, legal professionals, and other stakeholders in digital forensic investigations and legal proceedings.

List of Practicals:

Experiment No.	Experiment Topics	Practical Hours
01	Use malware analysis tools to analyze different types of malware samples (e.g., worms, viruses, Trojans).	2
02	Extract email artifacts from different sources such as client-based email applications, web-based email services, and internet-hosted mail servers	2
03	Convert email formats to analyze their content and metadata.	2
04	Perform forensic analysis on Internet Explorer, Firefox, and other web browsers to uncover user activities and preferences.	2
05	Acquire memory images from a live system or a memory dump.	2
06	Conduct MAC time analysis on file systems to track file creation, modification, and access times.	2
07	Develop an incident response plan outlining the steps to be taken in the event of a cybersecurity incident.	2
08	Collect and analyze data from mobile devices such as smartphones and tablets.	2
09	nalyze mobile device artifacts such as call logs, text messages, contacts, and installed applications.	2
10	Conduct security assessments of web applications to identify vulnerabilities and weaknesses.	2
11	Project	10